

South-Eastern Mediterranean Peoples Between 130,000 and 10,000 Years Ago

edited by
Elena A. A. Garcea



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Edited by
Elena A. A. Garcea

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Nick Barton teaches Palaeolithic archaeology at the Institute of Archaeology, Oxford University where he holds a Professorship and is a fellow of Hertford College. Since 2001 he has been co-directing a programme of multi-disciplinary fieldwork and research in Morocco, principally at the site of Grotte des Pigeons at Taforalt but also at various sites in the north and along the Atlantic coast of Morocco. He is currently principal co-investigator of the RESET project concerning Human Responses to Abrupt Climatic Events in the Late Pleistocene and a Leverhulme project investigating cemeteries and sedentism in the Late Palaeolithic of North Africa. His main research interests are: early human technologies; human evolution and environmental change; artefact taphonomy and site formation processes in caves.

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Acknowledgements

Elena A. A. Garcea

The initial idea for this book came from a weekend school on “The Mediterranean Peoples of the Upper Pleistocene”, organised by Diane Holmes and held in March 2003 at Rewley House in Oxford, home to Oxford University’s Department for Continuing Education. The school was open to all, a little curiosity with regard to human prehistory being the only requirement. The speakers were all scholars with active research interests in the Mediterranean region. The result was an intensive course that was stimulating for both the members of the public who attended and the speakers as they listened to each others’ presentations. On that occasion, someone suggested publishing the topics covered in the talks and Diane Holmes kindly took the initiative to bring together in a scientific format the contributions of the speakers. Some authors (Nick Barton, Brian Boyd, Pierre Vermeersch, and myself) promptly accepted, inviting other colleagues presently involved in their research projects as co-authors; others were unfortunately carried away by their many overwhelming tasks and withdrew.

In the meanwhile, also Diane Holmes’ engagements sadly diverted her away from this project and she could no longer comply with the commitments she had taken with the authors and the publishers. Abandoning the publication project seemed to be an unwanted and unfortunate choice, especially considering the remarkable progress research has made on the Upper Pleistocene in this part of the world. She then offered me to pursue the book and take up the baton as editor. I owe Diane my most sincere gratitude for encouraging and supporting me to be in charge of the book and, on behalf of all authors, I greatly thank her for conceiving the idea and for making the initial steps to refine those talks for a book.

When I took the editorship of this book, I suggested the

publisher to exclusively focus on the south-eastern Mediterranean basin in consideration of various compelling reasons. The Out-of-Africa movement and dispersal of *Homo sapiens* into Eurasia are amongst the most topical issues in current scientific debate on the archaeology of this time period. While the western part of the Mediterranean basin is well-known and in-depth studied since many years, current research projects in North Africa and the Levant have very recently provided new insights on the Out-of-Africa perspective. Ultimately, the Out-of-Africa 2 movement (that of *Homo sapiens*) is a topic taught in numerous university classes, not only those on the Mediterranean basin or in Africa, as it is of crucial interest to all courses on human evolution, prehistoric archaeology, anthropology, and palaeoenvironmental studies.

The contributions here are all freshly written and as up to date as possible. In addition to the original speakers at Oxford with research projects on the Upper Pleistocene south-eastern Mediterranean basin, thirteen researchers, Ofer Bar-Yosef, Anna Belfer-Cohen, Abdeljalil Bouzouggar, Laine Clark-Balzan, Simon Colcutt, André Debénath, Mohamed Abdeljalil El Hajraoui, Roland Nespoulet, Romuald Schild, Jean-Luc Schwenninger, John Shea, Jennifer Smith, and Fred Wendorf, have kindly accepted to contribute chapters to help ‘round out’ the content of the book. I am very thankful to all of them for accepting to be part of this endeavour.

Ultimately, my personal thanks go to Dr. Bruna Andreoni of the University of Cassino, Italy. She edited all the figures in this book and brought them to a highly professional, standardized format and produced several topographic maps. I am also very grateful to Sue Harmon for editing the English language.

Introduction: Goals and Challenges

Elena A. A. Garcea

Introduction and aims

This book is about the hunter-gatherers living in the land regions of the south-eastern Mediterranean basin between 130,000 and 10,000 years ago (130–10 ka BP), a span of time encompassing the previous warm interglacial stage (Marine Isotope Stage, MIS 5) and the last ice age (MIS 2), representing the Upper Pleistocene. The 120,000 years that are the focus of this book form a period of dramatic cultural developments.

At the beginning of this period, there were two hominin species in the Mediterranean region of Europe and South-West Asia: Neanderthals (*Homo neanderthalensis*) and some of the earliest representatives of modern humans, our own species (*Homo sapiens*). The Neanderthals became extinct well before the end of the last ice age, leaving not just the Mediterranean area, but the whole globe, to our modern human ancestors (e.g., Tattersall 1995; Shea 2003, 2007, 2008). On the other hand, the southern coast of the Mediterranean, on the African continent, was radically different from its bordering Eurasian lands as it was inhabited by *Homo sapiens* populations much earlier (since at least 200 ka BP, most likely earlier) and Neanderthals did not exist anywhere in Africa (e.g., McBrearty and Brooks 2000; Garcea 2004; McBrearty 2007).

The period under consideration was an eventful one, not only in terms of human developments. There were also dramatic changes in climate. Significant fluctuations in rainfall and water resource availability had a strong impact on human settlements in several areas of North Africa and the Levant, with interglacial, warm and rainy periods, and glacial, cool and arid intervals (e.g., Kallel *et al.* 2000; Bartov *et al.* 2002; Rohling *et al.* 2002; Haase-Schramm *et al.* 2004; Robinson *et al.* 2006; Legge *et al.* 2008; Abu Ghazleh and Kempe 2009; Smith 2010). This book does not claim to cover every aspect of the south-eastern Mediterranean prehistory of 130 to 10 ka ago. Important

focuses are the spread of anatomically modern humans from their African homeland, the transition from the Middle Palaeolithic/Middle Stone Age to the Upper Palaeolithic/Later Stone Age some time between *c.* 45 and 30 ka ago, and also the beginning of a totally new way of life, by 10 ka ago, based on plant cultivation and animal husbandry.

The aim of this book is to make information accessible. All too often the details get hidden away in specialist, and sometimes obscure, journals and other regionally specific and technical literature. For this purpose, and in order to reduce the difficulties in accessing local journals or excessively technically detailed articles, the section “Further reading” is addressed to those who do not have the opportunity or the interest to digest the vast complete bibliography on these topics. This book is intended to serve as a useful textbook, and at the same time to offer an up-to-date review of the south-eastern Mediterranean region. Each chapter supplies many more figures and tables than regular journal articles would allow, in the belief that visual images can often illustrate certain concepts much better than words. Furthermore, this book aims at highlighting and synthesizing some of the most recent discoveries made in the south-eastern Mediterranean region during the Upper Pleistocene, with a particular emphasis on North Africa and the Near East. The choice to focus on the south-eastern Mediterranean basin and, consequently, to omit Mediterranean Europe is due to the fact that the latter region has been studied in-depth and been a subject of ample debates for many years, whereas North Africa is a region which very seldom gets an airing outside of the regionally specific archaeological literature (e.g., Garcea 2004, 2010; Stringer and Barton 2008). Finally, this book aims at offering an opportunity to observe the Afro-Asian side of the Mediterranean basin as an uninterrupted land, as it must have been for its Upper Pleistocene anatomically modern inhabitants.

Contents

The chapters that follow are presented in a geographic sequence progressing from west to east, that is, from Morocco to Libya and Egypt, in North Africa, up to the Levant and the Near East, in South-West Asia (Fig. 1.1), and in chronological order, going from the Middle Palaeolithic/Middle Stone Age, to the Upper Palaeolithic/Later Stone Age and, lastly, to the Epipalaeolithic/Upper Later Stone Age. The next chapter, by Jennifer Smith, is a scene-setter, summarizing the palaeoenvironments of eastern North Africa and the Levant in the late Pleistocene. Chapters 3 to 7 explore the archaeological record of North Africa. Beginning from the Maghreb, Jean-Luc Schwenninger and colleagues, in Chapter 3, propose a reassessment of the Upper Pleistocene occupation of Morocco based on their most recent stratigraphic and chronological results. Chapters 4 and 5, written by me, focus on the area in North Africa between the Maghreb and the Nile Valley. In particular, Chapter 4 reviews the Aterian tradition which was widely distributed across the whole of North Africa as far east as the Western Desert of Egypt. Chapter 5 goes on to summarize what we currently know about the Later Stone Age of Libya. In Chapter 6, Pierre Vermeersch presents a synthesis of the Middle Palaeolithic in the Egyptian Nile Valley, its transition to the Upper Palaeolithic, and a review of the Upper and Late Palaeolithic. He also provides an insight into two behaviours that are not often preserved in the Palaeolithic

record: the burial of the dead, possibly as early as 75 ka BP, and flint mining at 40–35 ka BP. The Late Palaeolithic environment and cultures of Nubia and Upper Egypt are further discussed by Romuald Schild and Fred Wendorf in Chapter 7, who also examine the burials they excavated at Wadi Kubbanya and Gebel Sahaba to determine long-term warfare in the late Pleistocene Nile Valley.

The next three chapters focus on the Near East. John Shea, in Chapter 8, looks at the Middle Palaeolithic activities of both the Neanderthals and the first anatomically modern humans in the region, including subsistence strategies, burial practices and site organization, and considers how Neanderthal behaviour differed from that of the early modern humans and whether the two species actually came face-to-face in the area. By *c.* 50 ka BP, we see the beginning of a remarkable transition from the Middle Palaeolithic to the Upper Palaeolithic. Ofer Bar-Yosef and Anna Belfer-Cohen, in Chapter 9, discuss the implications of this transition and summarize what is known of the Levantine Upper Palaeolithic and the first phases of the Epipalaeolithic. Towards the close of the Pleistocene, in the Later Epipalaeolithic, there is evidence of increasing social complexity and changes in food procurement that finally led to crops being deliberately planted. Brian Boyd, in Chapter 10, takes us through these developments to the dawn of the Neolithic, food-producing age. Ultimately, Chapter 11, also written by me, is an attempt to draw together the threads on the status of the latest discoveries, interpretations, and discussions on

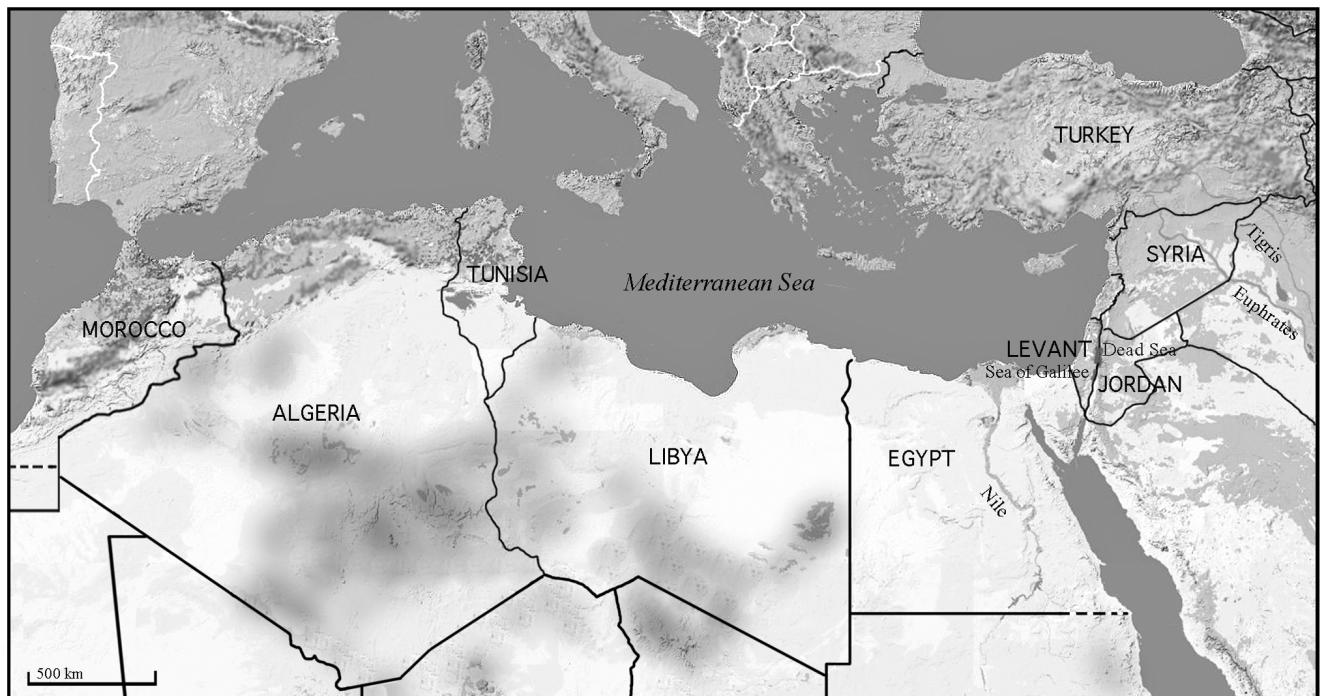


Figure 1.1. Map of the south-eastern Mediterranean basin.

the south-eastern Mediterranean peoples between 130 and 10 ka BP. It summarises and comments on some of the most crucial events, including the Out-of-Africa 2 movement, the Middle/Upper Palaeolithic transition, the cultural changes at the end of the Pleistocene, and the ultimate food production “revolution”, aiming at bridging the gap between in and out of Africa.

Before proceeding with the reading of this book, however, I have to warn readers that they will find different terminologies in the various chapters that may appear rather confusing. With regards to the African side, I prefer to comply with the terminology specifically created for African archaeology, and I employ *Middle Stone Age* and *Later Stone Age* (and I refer readers to Garcea 2009, for further explanations, and less tribulations), while Vermeersch and Schild and Wendorf prefer to continue to use the European-based terms of *Middle Palaeolithic*, *Upper Palaeolithic*, and *Late Palaeolithic*. The situation on the other side of the Mediterranean is not any simpler. A terminological “jumble” afflicts the Near East, as well. On one hand, the early Upper Palaeolithic in the Levant raises issues related to the late Middle Palaeolithic or the late Middle Stone Age in North Africa, on the other, the Levantine Epipalaeolithic is parallel to the late Upper Palaeolithic in Mediterranean Europe. Different opinions also concern the Levantine “Transitional Industries”, characterizing the technological and biological shifts from the Middle Palaeolithic to the Upper Palaeolithic in that region and their biologically different, Neanderthals vs. *sapiens*, makers (see Bar-Yosef and Belfer-Cohen, Chapter 9). To sum up, there seems to be a basic convergence among those scholars who work in North Africa and those who work in the Near East and are dissatisfied with the use of European-derived terminologies, which is the fact that these terminologies seem inadequate and inappropriate to describe the local cultural contexts of both North Africa and the Near East (Garcea, Chapters 4 and 5; Shea, Chapter 8; Bar-Yosef and Belfer-Cohen, Chapter 9). In order to overcome potential misunderstandings, terminology is defined rather than assumed and the significance of research endeavours is put into broad context.

The cultural units associated with the final part of the Pleistocene comprise the Iberomaurusian in Morocco, the Upper Later Stone Age or Iberomaurusian in Libya, the Late Palaeolithic in the Nile Valley, and the Epipalaeolithic in the Levant. In spite of the confusing and apparently contradictory terminologies, they do show some characteristics in common regarding the absolute chronology and technological solutions of the various industrial complexes. Comparing these cultural units confirms the usefulness of such a book which tries to make an interregional comparison of areas that underwent completely different, often opposed research histories and more recent historical events. Table 1.1 shows a synoptic correlation of the different cultural units and relative chronologies, aiming at providing readers

with a handy key to get through apparently confusing local terminologies, while they are referred to the individual chapters for precise and detailed descriptions of each cultural unit.

This book can neither find a solution, nor wants to impose “favourite interpretations”. It simply reports and respects differing opinions in view of a higher ambition: to enhance communication among scholars who work in different, but neighbouring regions and to discourage rivalries among those who work in the same regions. Communication and collaboration, in fact, are seriously needed for the advancement of science. The south-eastern Mediterranean basin, in particular, offers some of the most topical issues in the current scientific debate on the archaeology of this time period. This book hopes to give them the credit they deserve.

Different perspectives, common prospects

This volume brings together data and interpretations by scholars, usually separated in the scientific venues, the Eurasian world for those working in the Levant and the Near East, and the African world, or rather a little enclave of it, North Africa and the Nile Valley, which are in Africa, but rarely communicate with their colleagues working in neighbouring regions, be them the Near East, East Africa, or sub-Saharan Africa (*e.g.*, Kleindienst 2000; Garcea 2005). Although different perspectives exist, common prospects arise from this book and advocate the need to pursue a broad interregional outlook. The fact that different data can converge on common questions and shared needs suggests this is the correct way to proceed. This would be a truly innovative and long-needed approach, which could overcome the difficulties in understanding cultural similarities due to different terminologies and research methods, as Vermeersch (2001) has correctly lamented and reiterates in this book (Chapter 6).

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Marine Isotope Stage	Ages (cal ka BP and OSL)	Morocco (<i>Barton et al.</i>)	Libya (<i>Garcea</i>)	Egypt (<i>Vermeersch</i>)	Egypt and Nubia – 2nd/1st Cataracts (<i>Schild and Wendorf</i>)	Egypt and Nubia – 1st Cataract/Dishna (<i>Schild and Wendorf</i>)	Near East (<i>Shea</i>)	Levant (<i>Bar-Yosef and Belfer-Cohen</i>)	Levant (<i>Boyd</i>)
1	11.5–0				Arkinian (12.8–10 ka BP)				Later Epipalaeolithic – Natufian
2	24–11.5	Iberomaurusian	Upper Later Stone Age – Iberomaurusian (22–12 ka BP)	Late Palaeolithic (22–12.5 ka BP)	Sebilian (14.5–13 ka BP) Qadan (17.5–16.5 ka BP) Ballanan-Silsilian (19–17 ka BP) Halfan (22.5–22 ka BP)	Isnan (14.5–13.9 ka BP) Afian (16.5–14.5 ka BP) Ballanan-Silsilian (19–17 ka BP) Kubbaniyan (21–19.5 ka BP)	Early Natufian Mushabian and Ramonian Middle Epipalaeolithic – Geometric Kebaran Early Epipalaeolithic – Mazraan, Nebekian and Kebaran		
3	59–24	Aterian (Maghreb and Atlantic and Mediterranean coasts: >40 ka BP)	Lower Later Stone Age – Dabban (40–22 ka BP)	Upper Palaeolithic – Shuwikhatian (~25 ka BP) Upper Palaeolithic – Khaterian (40–35 ka BP)	Gemaian (>22 ka BP)	Fakhurian (≥24.4–22.5 ka BP) Idfuan-Shuwikhatian (25–20 ka BP)	Early Ahmarian (38–25 ka BP) Initial Upper Palaeolithic (45–38 ka BP)	Late Ahmarian (30–22 ka BP) Levantine Aurignacian (32–29 ka BP) Early Ahmarian (45–30 ka BP) Initial Upper Palaeolithic (50–45 ka BP)	
4	74–59	Aterian (Maghreb and Atlantic and Mediterranean coasts)	Middle Stone Age – Aterian (Sahara and Mediterranean coast)	Middle/Upper Palaeolithic transition – Taramsan Middle Palaeolithic – Lower Nile Valley Complex			Middle Palaeolithic – Levantine Mousterian, Phase 3 (71–45 ka BP)		
5	130–74	Aterian (Atlantic and Mediterranean coasts)	Middle Stone Age – Aterian (Sahara and Mediterranean coast) Early Middle Stone Age	Middle Palaeolithic – Nubian Complex			Middle Palaeolithic – Levantine Mousterian, Phase 2		

Table 1.1. Synoptic correlation of the different cultural units and relative chronologies.

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Palaeoenvironments of Eastern North Africa and the Levant in the Late Pleistocene

Jennifer R. Smith

The period from 130,000 to 10,000 (130–10 ka) ago was characterized by substantial variability in the habitability of vast stretches of eastern North Africa and the Levant, due to significant fluctuations in rainfall and thus water resource availability. Understanding occupation of, adaptation to, and migration through these regions, then, requires some knowledge of the regional environmental context and its variation through time. This chapter is intended not as an exhaustive recounting of each local climatic reconstruction performed within this broad area but rather as an overview of the nature of palaeoenvironmental records available within different regions of North Africa and the Levant, and as a synthesis of the magnitude and timing of climatic variation recorded therein. Marine (from the Mediterranean and Red Seas) and terrestrial climate archives will be discussed separately, as they contain environmental data of fundamentally different spatial and temporal scales (*e.g.*, Dincauze 2008). To maintain the south-eastern Mediterranean focus of this volume, terrestrial archives from the Levant, Sinai, Egypt, and Libya only will be primarily considered here, with palaeoenvironmental data from Chad and Sudan incorporated where possible. Mid- to late Pleistocene environmental change appears to be grossly synchronous across the east-to-west span of North Africa, therefore much of what is said about eastern North Africa will hold true for the broader region, though discrepancies may exist in the relative magnitude of successive humid (pluvial) phases as may small scale variation in the timing of onset and cessation of humid phases (Smith 2010).

Modern climate

The Levant and North Africa straddle two climate zones, the westerly system over the Mediterranean, and the subtropical or intertropical convergence zone (ITCZ) over North Africa (Fig. 2.1); the location of the boundary between these zones varies with time (Arz *et al.* 2003; Issar 2003). Westerlies currently bring winter (Nov.–Mar.) rains to

coastal North Africa and central Israel, but leave the Sinai and the Negev desert (and most of the Arabian peninsula) dry (Issar 2003). Winter rainfall amounts in these regions today are controlled in part by the North Atlantic Oscillation (NAO); a low NAO index favours winter storms in the Mediterranean, while under high NAO index conditions those storm tracks generally move further north (Moreno *et al.* 2005). Under current climatic conditions, summer rains associated with the African (Atlantic) and Indian Ocean monsoons, which water the Sahel and the eastern margin of the Arabian peninsula, do not penetrate far enough north or inland to provide rain to the Sahara or the Arabian desert. The northward migration and intensification of these monsoonal systems is a commonly invoked cause for enhanced humidity over the southern and central portions of the Saharo-Arabian region (*e.g.*, Petit-Maire *et al.* 1991; Sultan *et al.* 1997; Hoelzmann *et al.* 2000; Rohling *et al.* 2002; Larrasoaña *et al.* 2003; Smith *et al.* 2004a).

Marine records

Marine palaeoenvironmental records have the frequent advantage of long-term temporal continuity over many terrestrial archives, however, these records may often integrate climatic change over fairly broad regions. Typical environmental proxies analyzed from marine cores include, among others: terrestrial dust flux, recording terrestrial aridity and/or storminess (*e.g.*, Moreno *et al.* 2001; Bozzano *et al.* 2002; Larrasoaña *et al.* 2003); pollen, indicating terrestrial vegetation communities (*e.g.*, Rossignol-Strick *et al.* 1998; Magri and Parra 2002; Moreno *et al.* 2005); stable isotopic analyses of foraminifera, towards reconstructing water body isotopic composition (Rohling and de Rijk 1999; Kallel *et al.* 2000; Moreno *et al.* 2005); micropalaeontological taxonomy, indicative of fluvial or aeolian input (Lézine and Casanova 1991; Lézine *et al.* 2005). In Mediterranean Sea sediment cores, particular attention has been paid to sapropels, organic rich sediments laid down during times

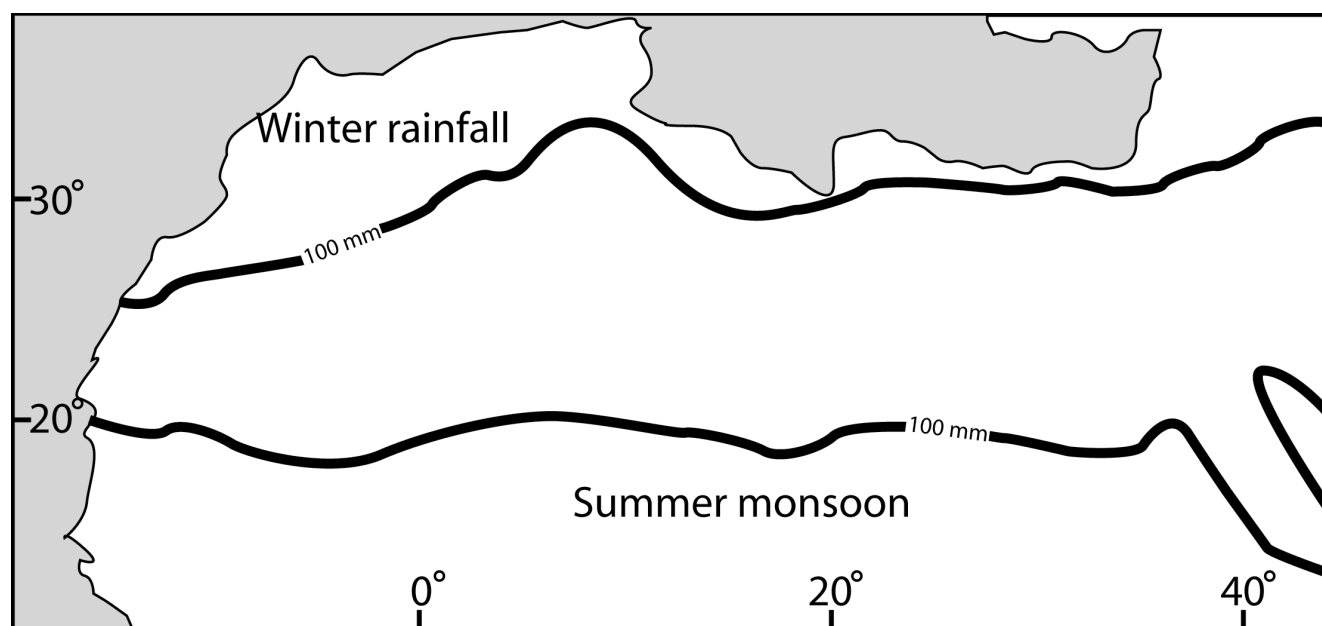


Figure 2.1. Modern Mediterranean and monsoonal rainfall regimes over North Africa and the Levant, defined using the 100 mm isohyet, following Arz *et al.* 2003.

of enhanced freshwater influx, which resulted in increased surface water productivity, bottom water anoxia, and reduced ventilation of the eastern Mediterranean (*e.g.*, Rossignol-Strick 1983, 1985; Bar-Matthews *et al.* 2000; Emeis *et al.* 2000; Kallel *et al.* 2000; Bard *et al.* 2002; Rohling *et al.* 2002; Larrasoña *et al.* 2006). These sapropels are of importance for understanding terrestrial climates as they are indicators of increased rainfall in the Mediterranean basin. Age control on sediment cores is generally provided by one or more of the following: radiocarbon dating, orbital tuning (*e.g.*, matching sapropel timing to the precessional index), and or correlation of oxygen isotope analyses to the SPECMAP stack (Kallel *et al.* 2000; Larrasoña *et al.* 2003; Lézine *et al.* 2005; Larrasoña *et al.* 2006).

Eastern Mediterranean Sea

In the eastern Mediterranean, Nile river discharge plays an extremely important role in the chemistry and sedimentology of basin floor deposits; the Nile is the principal contributor of sediment to the Levant Sea (Stanley *et al.* 1997; Hamann *et al.* 2009). In addition, increased Nile discharge is often invoked as a source of a portion of the fresh water input to the Mediterranean required for sapropel formation (Rossignol-Strick *et al.* 1982; Rossignol-Strick 1983; Jenkins and Williams 1984; Kallel *et al.* 2000), though Nile discharge alone was unlikely to be capable of sufficiently reducing Mediterranean salinity (Jenkins and Williams 1984; Kallel *et al.* 2004). Indeed, substantial discharge from a now-extinct Libyan river network occurred during the

deposition of sapropel S5, ~124–119 ka (Rohling *et al.* 2002; Osborne *et al.* 2008). Thus, while the simple presence of sapropel deposits indicates enhanced Mediterranean basin humidity at ~124 (MIS (Marine Isotope Stage) 5e), 102 (MIS 5c) and 81 ka (MIS 5a), within the 125–10 ka time period under consideration here (Emeis *et al.* 2000), additional data are required to constrain the magnitude and spatial extent of that humidity.

Pollen analyses of sapropel layers indicate an increase in Mediterranean evergreen and deciduous forest taxa in the Levantine margin during MIS 5e, 5c, and 5a, with conditions during 5e being the most conducive to forest expansion (mild and humid), followed by 5a and then 5c; the intervening times (MIS 5d and 5b) were characterized by desert taxa (Cheddadi and Rossignol-Strick 1995b). A particularly wet MIS 5e is independently supported by Nd-isotope evidence from a core in the western Ionian Sea indicating an active, integrated Libyan drainage network stretching from the southern Sahara to the Mediterranean (Osborne *et al.* 2008). During later periods (MIS 4–3) arid-adapted vegetation (semi-desert and desert) dominated, though enclaves of forest would have survived (Cheddadi and Rossignol-Strick 1995a). Vegetation records, and therefore likely climates, were more variable during MIS 3, which was followed by a cold and dry Last Glacial Maximum (Cheddadi and Rossignol-Strick 1995a). A complementary climatic reconstruction can be made using the varying amounts of hematite-rich dust in eastern Mediterranean cores (Larrasoña *et al.* 2003); this terrestrial

dust, sourced in western Egypt, Libya, and eastern Algeria north of 21° latitude, is present in increased amounts when these regions were relatively arid (dust levels are low in sapropel layers). Dust flux exhibits strong orbital control, with a significant precessional signal, indicating climatic cyclicity in the above mentioned region with a ~20 ka periodicity. Mediterranean records are also capable of resolving shorter-term climatic variation; Rohling *et al.* (2002) document an ~800 year reduction in (most likely) discharge from Libyan wadis during the MIS 5e humid phase; coincidence of this event with higher-latitude climate shifts suggests monsoonal rainfall was sensitive to and/or driving global fluctuations in heat transfer mechanisms.

It is from these and similar marine climate archives in the eastern Mediterranean that the broad outlines of regional environmental variation can be most easily discerned: humid conditions during MIS 5e, 5c, and 5a, arid climates similar to those of today during MIS 4 and 2, and slightly enhanced humidity relative to the present but with significant variation during MIS 3. These records also contain evidence of smaller magnitude and shorter term fluctuations that would be exceedingly difficult to extract from most available terrestrial records. However, terrestrial records are still necessary to understand sub-regional differences in climate as well as any asynchronicity in climatic fluctuations across the larger area.

Red Sea

Because the Red Sea is relatively small, and sometimes restricted (during glacial periods/sea level lowstands), the chemistry of Red Sea water may vary significantly over time, and as such provide a sensitive environmental record (Almogi-Labin *et al.* 1998; Legge *et al.* 2008); *e.g.*, salinity varied between 38‰ and 53‰ between the last interglacial period and the present (Hemleben *et al.* 1996). Fewer data are available on climatic reconstructions from Red Sea sediments than from the Mediterranean, however, at least some of the Red Sea-based reconstructions illustrate the same general climatic pattern described above, with increased precipitation generally occurring during interglacial periods (Strasser and Strohmenger 1997; Almogi-Labin *et al.* 1998), including a signal of particularly significant regional rainfall during MIS 5e (Hoang and Taviani 1988; Hoang *et al.* 1996; El Asmar 1997). Certainly some differences do occur; pteropod abundances in the Red Sea suggest greater humidity during MIS 5c than MIS 5a (Almogi-Labin *et al.* 1998), as indicated by Mediterranean records (see above). However, dust inputs to the Red Sea suggest, similar to Mediterranean records, prominent humid phases in desert regions during MIS 5e and 5a (as well as several earlier), overprinted on an overall trend over the last 350 ka towards greater loess (Saharo-Arabian dust) input and therefore greater aridity (Stein *et al.* 2007). Also, Red Sea nannoplankton assemblages indicate both a climatically

variable MIS 3 in the Red Sea basin (similar to Mediterranean pollen records, see above), and coupling to centennial-millennial scale events in higher latitudes during that time (Legge *et al.* 2008), as demonstrated for MIS 5e by Rohling *et al.* (2002).

Red Sea records have the potential to go beyond simple refinement of climatic sequences based on Mediterranean or terrestrial archives; first, gradients in Red Sea chemistry during humid phases may be able to distinguish between Mediterranean winter and monsoonal summer rains as sources for regional moisture, as demonstrated for the Holocene (Arz *et al.* 2003). Second, corals represent a unique high-resolution marine palaeoenvironmental proxy within the region; fluorescent banding in corals can indicate a seasonal rainfall regime (related to humic acid transport from runoff), while the density of the fluorescent band can be used to determine rainfall season (summer vs. winter; Klein *et al.* 1990). Such banding in MIS 5 age corals in the Gulf of Eilat suggests summer (monsoonal) rainfall penetrated far enough north during this intense humid phase to cause significant runoff from the Sinai Peninsula (Klein *et al.* 1990). Extending studies such as these, with the potential to discriminate between winter and summer rainfall, would be exceedingly useful in better understanding the climate dynamics of this region.

Terrestrial records

In the largely arid south-eastern Mediterranean region, extensive continuous environmental archives are often lacking; shifts between semi-arid and arid climates are more likely to result in a shift from deposition of water-lain sediments to non-deposition, rather than to cause a change in the nature, style, or chemistry of deposition. The very notable exceptions here are Levantine speleothem records (Bar-Matthews *et al.* 1997, 2000; Kaufman *et al.* 1998; Ayalon *et al.* 1999; Bar-Matthews *et al.* 1999; Frumkin and Stein 2004), though some speleothems in marginal, arid regions may only record growth during relatively humid times (Vaks *et al.* 2003, 2007). Isotopic and minor element chemistry of speleothems, constrained by U-series ages on speleothem precipitation, provides reconstructions of climatic parameters such as rainfall, evaporative potential, soil/vegetation productivity, and groundwater processes (Ayalon *et al.* 1999; Hellstrom and McCulloch 2000; Frumkin and Stein 2004; Hellstrom 2004; Zhou *et al.* 2005; Johnson *et al.* 2006).

Apart from speleothem records, most terrestrial archives of environmental change in the south-eastern Mediterranean consist of lacustrine, fluvial, or spring deposits in regions too arid to currently support extensive surface water. The sedimentology, geochemistry (isotopic and minor element), mineralogy, and micropalaeontology of lacustrine and spring sediments can be used as proxies for a variety of environ-

mental variables; typically the most robust relationships are those which allow for the reconstruction of precipitation/evaporation (P/E), biological productivity, and water salinity (Turi 1986; Leng and Marshall 2004; Smith *et al.* 2004a; Andrews 2006; Leng *et al.* 2006; Kieniewicz and Smith 2009). Direct chronological control on these sedimentary archives can be provided by radiocarbon (*e.g.*, Szabo *et al.* 1991, 1995; Kuper and Kröpelin 2006), U-series (Schwarcz and Morawska 1993; Crombie *et al.* 1997; Sultan *et al.* 1997; Smith *et al.* 2004b, 2007; Geyh and Thiedig 2008; Kleindienst *et al.* 2008), OSL (Thorp *et al.* 2002; Bray and Stokes 2004; Weisrock *et al.* 2006; Armitage *et al.* 2007), and ESR techniques, though difficulties still exist in generating consistent ages from different techniques (*e.g.*, Wendorf *et al.* 1993; Weisrock 2003; Armitage *et al.* 2007).

The Nile river

The Nile is the dominant watercourse within the south-eastern Mediterranean region, and its valley was undoubtedly critically important habitat for Pleistocene inhabitants (*e.g.*, Butzer and Hansen 1968; Wendorf and Schild 1976) as well as a potential migration corridor through the region (*e.g.*, Van Peer 1998). Variation in Nile flows and Nile Valley environments are examined in two other chapters (Vermeersch, Chapter 6; Schild and Wendorf, Chapter 7); the reader is referred to these chapters for detailed discussions of Nile alluvial chronology, which will not be repeated here.

The Levant and the Sinai peninsula

Palaeoenvironmental archives are somewhat more easily obtainable in the Levant; this subregion is both wetter and contains more tectonic basins capable of trapping sediment (*e.g.*, the Dead Sea) than the North African portion of the south-eastern Mediterranean.

DEAD SEA SYSTEM

Extensive work has been done on the sedimentology and geochemistry of lake sediments surrounding the modern Dead Sea, which record significantly larger water bodies occupying basins associated with the Dead Sea transform fault system during the late Quaternary, *e.g.*, Lake Samra (Kaufman *et al.* 1992; Waldmann *et al.* 2007), Lake Lisan (Buchbinder *et al.* 1974; Katz and Kolodny 1977; Druckman *et al.* 1987; Niemi 1997; Stein *et al.* 1997; Machlus *et al.* 2000; Bartov *et al.* 2002; Landmann *et al.* 2002; Begin *et al.* 2004; Haase-Schramm *et al.* 2004; Belmaker *et al.* 2008; Torfstein *et al.* 2008; Abu Ghazleh and Kempe 2009), and Lake Kinneret (Heimann and Braun 2000; Hazan *et al.* 2005).

Lake Samra (or Samra Fm. deposits) is the water body which occupied the Dead Sea basin during the last interglacial, ~140–70 ka, prior to Lake Lisan/Lisan Fm. (Kaufman *et al.* 1992; Niemi 1997; Waldmann *et al.* 2007). The Samra

Fm. consists of calcitic lacustrine marls capped by fluvial carbonates (tufas) and gravels; the calcite marls are interpreted as detrital sediments from seasonal floods, cemented by calcite in a freshwater setting, with occasional episodes of primary calcite precipitation within the lake (Waldmann *et al.* 2007). Though Lake Samra levels were comparable to Holocene Dead Sea surface elevations, ~370 m below mean sea level, and thus represent “lowstands” relative to Lake Lisan (see below), the lack of brine input due to a relatively low rate of groundwater recharge during this time is thought to explain the “freshwater” signal represented by the primary calcite (Waldmann *et al.* 2007).

Lake Lisan was, at its greatest extent, a ~220 km long lake that stretched from slightly south of the current Dead Sea north to the Sea of Galilee (Niemi 1997); it existed from ~70–15 ka, after which a regression towards the current extent of the Dead Sea took place (*e.g.*, Stein *et al.* 1997; Haase-Schramm *et al.* 2004; Torfstein *et al.* 2008). Lake level fluctuations during this time were substantial, with lake surface elevations varying between ~340 and 160 m below mean sea level (Bartov *et al.* 2002). Lake highstands are characterized by deposition of aragonite, while gypsum dominates during lowstands; Haase-Schramm *et al.* (2004) note a correlation between highstands and cool glacial periods (MIS 4 and 2), and lowstands with warmer periods (MIS 3 and 1). This is the more common “dry interglacial” pattern seen in systems dominated by Mediterranean winter rainfall.

SPELEOTHEM RECORDS

The Soreq Cave speleothems (Kaufman *et al.* 1998; Ayalon *et al.* 1999; Bar-Matthews *et al.* 1997, 1999, 2000) are perhaps the most detailed and informative terrestrial palaeoenvironmental proxies in the south-eastern Mediterranean. A composite record of the last ~140 ka was developed by analysis of a series of speleothems of overlapping age, each providing a portion of the archive (Bar-Matthews *et al.* 2000). The isotopic geochemistry of Soreq speleothems appears to reflect largely the same temporal pattern of regional rainfall as sapropel records: enhanced humidity during MIS 5e, 5c, and 5a, though the speleothem also records increased precipitation around 54 and 36 ka (Ayalon *et al.* 1999; Bar-Matthews *et al.* 2000). Interestingly, the Soreq climate record is sometimes in phase and sometimes out of phase with the Lake Lisan archive; both indicate humidity around 54 ka (Stein *et al.* 1997; Bar-Matthews *et al.* 2000), but around 36 ka Lake Lisan levels dropped slightly (Bartov *et al.* 2002; Landmann *et al.* 2002). During the significant Lisan highstand around 25–20 ka (Bartov *et al.* 2002; Landmann *et al.* 2002), Soreq records indicate an intermediate/semi-arid level of rainfall (Bar-Matthews *et al.* 1997), with enhancement of precipitation beginning at ~17 ka, and culminating in a particularly

wet early Holocene (Ayalon *et al.* 1999). Lake Lisan began its recession towards modern Dead Sea levels around 17–15 ka (*e.g.*, Niemi 1997). A causative mechanism for antiphase relationships in such spatially proximal archives is not immediately obvious.

Speleothem studies in the Levant were not restricted to Soreq Cave; Sr-isotope analyses of a cave near Jerusalem provided a 220 ka record of dust inputs to the region, and U-isotope analyses of the same speleothem were used to reconstruct local hydrology; in this case, dust flux records reflected minima during enhanced monsoons (generally interglacial), reflecting reduction in Saharan dust supply during humid times in North Africa, while U-isotope reconstructions of hydrology were more consistent with the picture of dry interglacials in the Levant, similar to the Lisan records (Frumkin and Stein 2004). The existence of a “transition zone”, between a more Mediterranean climate with wet glacial periods, and a more Saharan climate with wet interglacial/interstadial periods is indicated by determination of ages of speleothem growth in the northern Negev desert, near the modern climatic interface between these zones (Vaks *et al.* 2006). Speleothems grew principally during glacial periods, consistent with a more Mediterranean climate, though growth occasionally also occurred (with some evidence for a more southerly, Atlantic rainfall source) during interglacial periods (Vaks *et al.* 2006). Speleothems from central and southern Negev, however, show a clearer signal of interglacial (140–110 ka) growth, associated with monsoonal rainfall (Vaks *et al.* 2007). The spatial resolution provided by these detailed studies allows for the previously impossible determination of the boundary between these climatic zones, and thus greatly enhances our understanding of regional differences in climate.

FLUVIAL AND COASTAL SEDIMENTARY AND SOIL RECORDS

Palaeoenvironmental records in the Levant are by no means restricted to cave sediments and Dead Sea basin deposits, though other palaeoenvironmental archives tend to be discontinuous, relatively young (MIS 4 or later), and reconstructions often qualitative. Soil formation is a rather ubiquitous process which can provide a record of alterations in dominant surface processes. Relatively wet last glacial conditions on the northern (Cohen-Seffer *et al.* 2005) and central (Gvirtzman and Wieder 2001) Israeli coast resulted in enhanced pedogenesis; though the Mikhmoret Hamra soil, which formed between 40–12.5 ka, showed clear evidence of aeolian input, soil formation was active enough to keep pace with the consistent (Saharan) dust flux (Gvirtzman and Wieder 2001). In the western Negev, wadi systems over the last 60 ka are similarly characterized by cyclic sedimentation, pedogenesis, and erosion, where again the interplay between extra-local dust flux and local climate determines the nature of the stratigraphic sequence deposited (Zilberman and Schick 1993). Here, significant dust flux

under a semi-arid climate with frequent low intensity rains results in the reworking and redeposition of aeolian material on floodplains, while low dust flux with a similarly semi-arid climate yields pedogenesis, and arid climates, accompanied by occasional high intensity rain storms, result in erosion (Zilberman and Schick 1993). Pedogenesis in the western Negev was centred on 35–30 ka, 27–24 ka, and 14–12 ka, reflecting enhanced glacial humidity (Zilberman and Schick 1993), as in more northern soil stratigraphy. Isotopic gradients in soil carbonates from similar aged palaeosols across the Negev indicate that, in all three of these times of increased pedogenesis, the moisture source was from the north, while relatively depleted $\delta^{13}\text{C}$ values in the ~28 ka palaeosol suggest wetter conditions during its formation (Goodfriend 1999). Approximately between these periods of relative stability, from 33–29 ka, anomalously intense floods were documented across the Negev; though significant rainfall events occurred, the region was likely to have remained overall fairly arid (Greenbaum *et al.* 2006). These local records for MIS 3 are generally consistent with Mediterranean pollen cores (Cheddadi and Rossignol-Strick 1995a) suggesting substantial climatic variation during this time.

Thus, while marine sediments in the Mediterranean and Red Sea generally contain a climatic signal dominated by interglacial/interstadial monsoonal rainfall coming from the south, terrestrial records north of the Negev are often out of phase, with humidity occurring principally during glacial times. While a number of individual studies have made progress towards understanding the location of the interface between these two climatic zones (*e.g.*, Vaks *et al.* 2006), complexities remain in understanding the climate dynamics of the late Pleistocene.

Eastern North Africa

Climate archives in eastern North Africa most frequently consist of sediments indicative of climates more humid than those of the present. The strong aeolian deflation during arid phases (providing dust influxes to the Mediterranean, Red Sea, and Levant discussed above) generally precludes much preservation of stratigraphy related to arid intervals.

LACUSTRINE RECORDS

Extensive Pleistocene lacustrine sediments are known from Dakhleh Oasis, central Egypt (Churcher *et al.* 1999; Kieniewicz and Smith 2009; Churcher and Kleindienst in press), southern Egypt/northern Sudan (McKenzie 1993; Schwarcz and Morawska 1993; Wendorf *et al.* 1993; Szabo *et al.* 1995), and the Fezzan basin in Libya (Armitage *et al.* 2007; Drake *et al.* 2008; Geyh and Thiedig 2008; see Fig. 2.2); most of what is known about Megalake Chad is restricted to its early Holocene highstand (Leblanc *et al.* 2006a, 2006b). Lacustrine sediments are often authigenic calcite silts (marls) and record deposition in perennial fresh

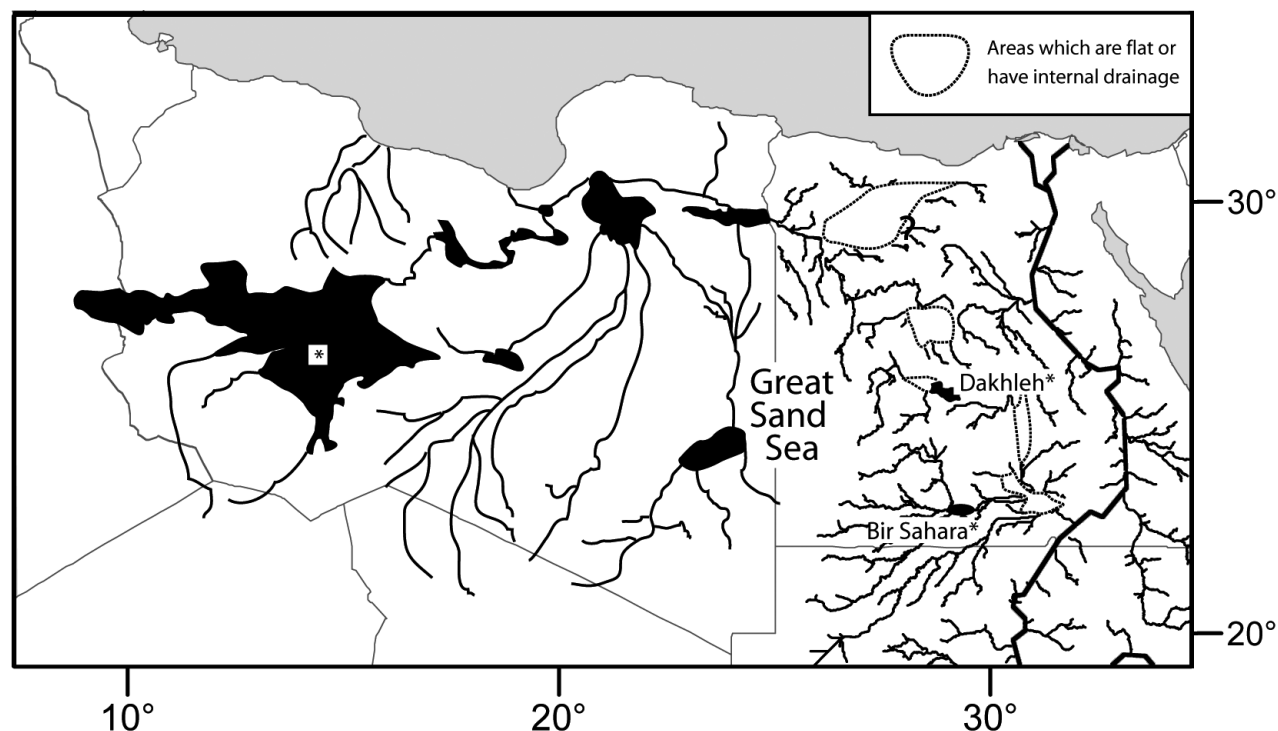


Figure 2.2. Locations of surficial water features present during pluvial phases in eastern North Africa. While some of these features (indicated by an asterisk) have been directly dated to the MIS 5 pluvial phase, others are constrained in age only to the Pleistocene. Libyan lakes and rivers from Drake *et al.* 2008. Dakhleh lake extent from Kieniewicz and Smith 2009, Bir Sahara/Bir Tarfawi location from Wendorf *et al.* 1993. Drainage network in Egypt and northern Sudan was determined (this study) from modern topography and thus only represents channels potentially active during the Pleistocene.

to brackish water over centuries at a minimum, and likely millennia (McKenzie 1993; Geyh and Thiedig 2008; Kieniewicz and Smith 2009). The Egyptian palaeolakes were most likely active primarily during MIS 5 (Wendorf *et al.* 1993; Kieniewicz and Smith 2009), with the southern lake systems being rather better chronologically constrained. Middle Stone Age artefacts stratigraphically associated with the Dakhleh lake sediments are not inconsistent with MIS 5, though older phases of lacustrine activity cannot be ruled out (Churcher *et al.* 1999; Churcher and Kleindienst in press).

Lake Megafezzan also had a period of activity during MIS 5, with Drake *et al.* (2008) reconstructing a lake of 1730 km² at that time, and Geyh and Thiedig (2008) one of ~1400 km². Though chronological control does not exist for all Libyan closed depressions, Drake *et al.* (2008) suggest that were these all flooded synchronously during humid phases, as much as 10% of the surface area of Libya may have been underwater. Despite the extensive surface area of these lakes (the Dakhleh lake basin is also reconstructed at ~1700 km²; Kieniewicz and Smith 2009), climates were likely to have remained semi-arid; faunal evidence and water balance calculations for the Dakhleh lake suggest annual

rainfall on the order of 400 mm (Kieniewicz and Smith 2009). Isotopic evidence from authigenic lacustrine carbonates as well as the age of the lacustrine sediments is consistent with Atlantic (south-western) monsoonal rainfall supporting the lakes (*e.g.*, Sultan *et al.* 1997; Smith *et al.* 2004a).

There is no evidence for the existence of substantial lakes in the Eastern Sahara following MIS 5 and prior to MIS 1; monsoonal indices are relatively low from MIS 4-2 (Rossignol-Strick 1983), so times of enhanced humidity would be expected to be relatively brief and low-intensity.

SPRING DEPOSITS

Spring carbonates lining the Libyan Plateau escarpment in Egypt's Western Desert have been studied for the past century (Ball 1900; Caton-Thompson 1952; Crombie *et al.* 1997; Luo *et al.* 1997; Sultan *et al.* 1997; Nicoll *et al.* 1999; Brook *et al.* 2003; Smith *et al.* 2004b, 2007). While oasis depression spring discharge may occur along faults even during hyperarid conditions such as those of today, spring discharge at elevation along the plateau escarpment requires substantially enhanced recharge to local aquifers, thus, spring carbonates were deposited during times of local

rainfall. These carbonates were deposited in fluvial, shallow lacustrine, and paludal settings (Crombie *et al.* 1997; Nicoll *et al.* 1999; Smith *et al.* 2004b; Kieniewicz and Smith 2007). The recharge needed to activate a few springs is less than that needed to support large surface-area lakes; thus, tufas could record smaller scale humid events. Nonetheless, the bulk of tufa deposition in the Western Desert occurred synchronously with lake activity during MIS 5, particularly during MIS 5e, 5c, and 5a (Brook *et al.* 2003; Smith *et al.* 2007), with only the occasional later evidence for spring activity.

FLUVIAL AND OTHER RECORDS

Though active surface drainage networks do not exist outside of the Nile in the eastern Sahara, relict river channels have been discovered buried under recent aeolian sediment by use of Shuttle-borne and satellite radar, which can penetrate shallow sand cover (McCauley *et al.* 1982; McHugh *et al.* 1988b; Robinson 2002; Paillou *et al.* 2009). These drainage networks stretch through southern and western Egypt and northern Sudan (McHugh *et al.* 1988a, 1988b), and cross Libya (Osborne *et al.* 2008; Paillou *et al.* 2009). Drainage networks presumed to have been active during the Pleistocene have also been identified associated with Libyan lake basins (Fig. 2.2; Drake *et al.* 2008). These would have been important migratory corridors through the central Sahara, though the age of activity along these networks is difficult to constrain.

Though extensive lacustrine or spring deposition generally did not occur in the eastern Sahara outside of oases during glacial periods (Brookes 1993a; Kleindienst 1999; Adelsberger and Smith in review), there are certain indicators of conditions somewhat less arid than the present between MIS 4 and 2. Enhanced groundwater activity in the Egyptian Western Desert, presumably due to local recharge during MIS 4, is documented by direct dates on remobilized uranium in Quaternary sediments (Osmond and Dabous 2004) and one small remobilized Western Desert tufa deposit dated to ~50 ka (Smith *et al.* 2004b). A small lacustrine deposit in the Western Desert was also dated to 62 ka (Brookes 1993b) and a secondary calcrete to 40±10 ka (Churcher *et al.* 1999). A paleosol, suggesting moderately enhanced moisture, formed at Ain Shakshuk in north-western Libya at ~44 ka BP, and fault controlled springs would have been intermittently active in this region throughout the Late Pleistocene (Garcea and Giraudi 2006). However, aeolian deposits in north-western Libya dated to MIS 2 and 4 suggest northward expansion of the Saharan margin toward the Mediterranean at this time (Giraudi 2005). Nonetheless, it is still possible that brief humid phases did occur during this predominantly arid period, though the extent to which the region would have been habitable is difficult to determine.

Conclusions

Mediterranean and Red Sea records of south-eastern Mediterranean climates, as well as terrestrial records from eastern North Africa and the Negev, suggest much of this region underwent largely synchronous climatic shifts, with interglacial or warm periods characterized by enhanced monsoonal rain, and glacial or cool periods comparatively arid. The larger climatic trend in the region over the past several hundred thousand years, though interrupted intermittently by humid phases, has been towards increased aridity. The central and northern portions of the Levant, however, appear to be out of phase with the rest of the area, exhibiting enhanced, presumably winter, rainfall during cool glacial times. In the rest of North Africa, this pattern of the latest Pleistocene (MIS 4 to 2) containing the most evidence for humid conditions is repeated only in Morocco, though MIS 3 is perhaps better represented in Moroccan humid phases than in Levantine ones (Smith 2010). This may indicate that humid phases between MIS 5 and 1 may have been driven primarily by increases in Mediterranean winter moisture. However, palaeoenvironmental records do suggest both that monsoonal rainfall may occur as far north as the Sinai peninsula (Klein *et al.* 1990), and that Mediterranean winter rains may have penetrated further south during at least the Holocene monsoonal maximum (Arz *et al.* 2003); thus, distinguishing between these two rainfall sources may be difficult. The Levantine region would certainly have been more hospitable in terms of water resources than the North African desert after the end of MIS 5, though evidence for occasional Saharan humidity during that time indicates at least portions of the desert would have been intermittently habitable even prior to the onset of the Holocene humid phase.

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A New Luminescence Chronology for Aterian Cave Sites on the Atlantic Coast of Morocco

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Introduction

Despite the long term recognition of the Aterian as a distinctive North African Middle Palaeolithic industry, comparatively little is understood about its dating. Until now the conventional view has been that the Aterian in Morocco falls mainly within the age range of radiocarbon dating but this idea has recently been put to the test with the application of other techniques that provide a chronology that extends back beyond 50 ka BP (Wrinn and Rink 2003; Bouzouggar *et al.* 2007; Barton *et al.* 2009). Renewed interest in the chronology of the Aterian has also partly arisen from the proposal that its development and spread may have been linked to the dispersal of anatomically modern humans (McBrearty and Brooks 2000). Of related significance is the question of cultural innovations, such as shell bead ornaments, worked red pigment, the manufacture of projectile and bifacial points and possible evidence for a bone tool technology, that typify the Aterian and may prefigure the emergence of fully modern behaviour (Bouzouggar *et al.* 2007; Nespoulet *et al.* 2008; Bouzouggar and Barton 2010).

In this paper we present new optically stimulated luminescence (OSL) dating evidence from four cave sites located south of Rabat on the Atlantic coast of Morocco (Fig. 3.1). The significance of Morocco is that it contains one of the richest concentrations of this industry in the whole of North Africa, an observation already made by Caton-Thompson over sixty years ago (Caton-Thompson 1946). The dating evidence discussed here is from sites on the extreme western edge of a geographical distribution of material that includes the Maghreb and the Sahara and continues across into the western desert of Egypt. The age of the Aterian on the Atlantic margin therefore has direct relevance for other questions concerning the geographic origins of this industry whether they lay in the south (Caton-Thompson 1946) or in the east (Watson *et al.* 1997; Van

Peer 1998; Osborne *et al.* 2008), or indeed even suggest a development indigenous to north-western Africa (Ferembach 1985). In any event, such ideas can only be fully explored and underpinned with the help of a secure chronology within this key region.

Site descriptions and archaeology

Dar es-Soltan, sites I and II

Dar es-Soltan I (DeS I) is one of several cave openings (Fig. 3.1) occurring within a low calcarenite coastal cliff (33°58'44"N, 6°53'51"W). The cave entrance faces west (300° magnetic), towards the ocean, with the modern shoreline nearly 260 m distant. The cave is at least 43 m deep and more than 6 m wide, with a thickness of *c.* 8 m of deposits throughout. An initial excavation of DeS I was carried out in 1937–38 by Armand Ruhlmann of the *Inspection des Antiquités du Maroc* (Ruhlmann 1951) who described a 7.5-m-thick sequence extending from assumed bedrock to the roof of the cave. Ruhlmann's stratigraphic section of the cave deposits comprised 12 layers (M-A), with a major rock fall shown between Layers C and B. Three discrete Aterian layers were recognised, each separated by 'sterile' deposits and overlain by a Neolithic shell midden layer near the summit.

A re-examination of the cave sediment sequence combined with sampling for OSL dating was undertaken by the authors in 2005 and 2008 and included the opportunity to assess the Ruhlmann collection. The results have recently been published elsewhere (Barton *et al.* 2009) but, in summary, we can say that we recognise many more archaeological units than first seen by Ruhlmann (see Fig. 3.2). Nevertheless, we were able to confirm that the lowermost Aterian layer (I) displayed a significant Levallois component including very small cores. The tools were

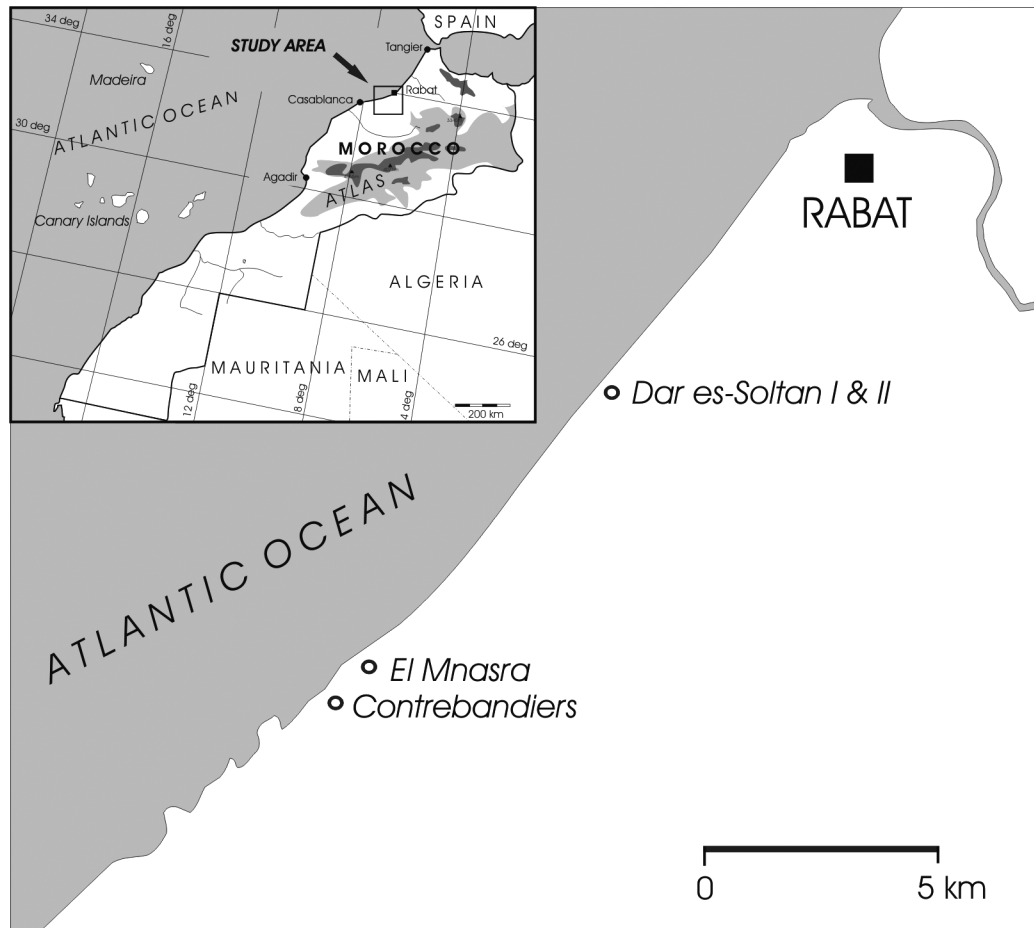


Figure 3.1. Location map of cave sites.

dominated by pedunculates and several bifacially flaked foliate points. The overlying cultural layer (C2) also reflected the use of Levallois and discoidal core technology with the range of tools displaying a markedly similar pattern to that of the lower industry. The inventory includes a variety of sidescrapers, mostly offset examples (*racloirs déjetés*), as well as pedunculate points and scrapers. The uppermost industry (C1) is more difficult to evaluate because it came from two different areas of the cave and from the descriptions could be mixed. However, even though there were no typical Aterian tools, the technology includes elements in common with the lower layers. The stratigraphic position of these finds and their sediment descriptions are summarised in Table 3.1.

Dar es-Soltan II (DeS II) is another west-facing cave located around 80 m south of DeS I. The site was discovered in 1969 and several archaeological excavations took place during the 1970s (Debénath 1972, 1975, 1976; Ferembach 1976b) in a restricted area near the cave mouth, the interior remaining completely choked with sediment. Like Dar es-

Soltan I, the sedimentary fill is dominated by sandy sediments (see Table 3.2) but the *c.* 5 m of observable sequence is highly compacted in its earlier levels and includes (possibly slightly displaced) cemented remnants, large aeolianite (bedrock) blocks and very obvious (probably biogenic) unconformities (see Fig. 3.3). There were Neolithic and a few Iberomaurusian finds (including a complex burial, Debénath 1976, 2000) in the bulk of the sequence, but the critical point is that the original excavations recovered human cranial remains apparently deposited in the top of a true beach sand (layer 7), low in the sequence, although a diagnostically Aterian lithic assemblage has not yet appeared directly associated with the cranium or elsewhere at this level. There is also no outright consensus on the precise taxonomic attribution of the human cranial finds (cf. also Ferembach 1976b; Hublin *et al.* 2010).

El Mnasra

The site was discovered and tested in the 1950s by Jean Roche (Debénath 2000, 140) and is located in Témara, on

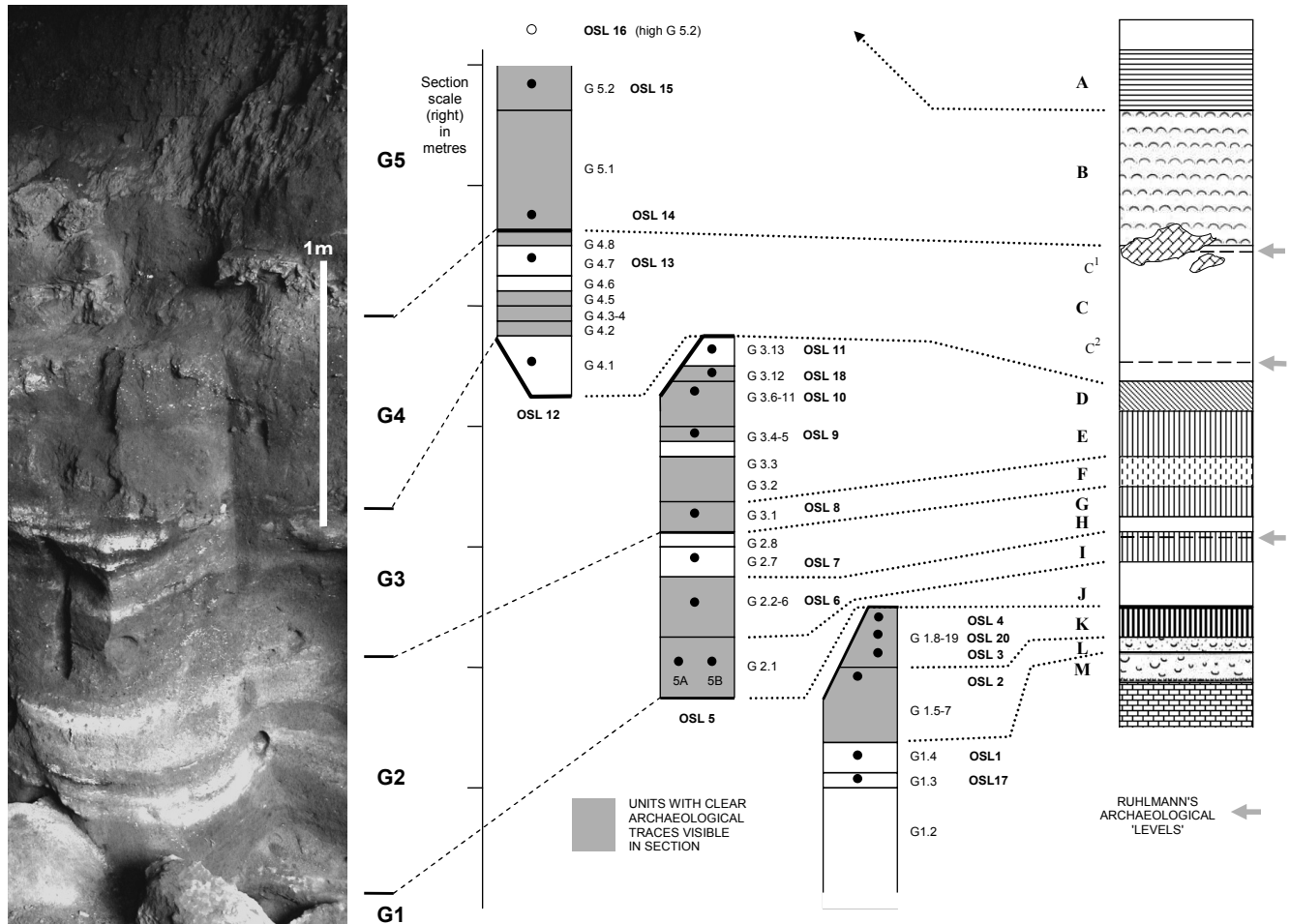


Figure 3.2. Dar es-Soltan I (adapted from Barton *et al.* 2009).

the outskirts of Rabat (Fig. 3.1). Its entrance faces west onto Témara beach, about 500 m from the actual shoreline (33°55'41"N, 6°57'13"W) and the top of the cave is *c.* 14 m above sea level. The cave covers an area of approximately 228 m², with maximum demonstrated dimensions of 22 m in length, 17 m in width, and 6 m in height. First excavations at the cave were undertaken by Jean Roche in the 1960s (Ferembach 1976b; Lacombe *et al.* 1991) and these were followed by more extensive work from 1990 onwards by one of the authors (El Hajraoui 1993, 1994, 2004). Beginning in 2004, a new phase of fieldwork occurred under the co-direction of El Hajraoui and Debénath (Nespoulet *et al.* 2008).

The fill of the cave is dominated by sandy and silty sediments and the stratigraphic sequence contains 13 distinct layers numbered from top to bottom (Nespoulet *et al.* 2008; see Table 3.3 and Fig. 3.4). Layers 2 and 3 are attributed to the early Neolithic (Cardial for layer 3), and layers 4 to 7 to the Aterian. Level 4 was recognised only on a small surface and yielded only a few objects identifiable to a Middle

Palaeolithic origin (in particular, a unifacial foliate and a tanged Levallois blade). The underlying levels, especially levels 5 to 7, were assigned to the Aterian. Level 5, the richest of these, is characterised by a debitage technique with a low Levallois index (≈ 10). Platforms are mainly unfaçetté. Although all stages of the *chaîne opératoire* are represented in the assemblage, there are very few unworked blocks of raw material, as well as few retouched flakes. Scrapers constitute the most important group of tools, with single and double types predominating, as well as convergent and transversal varieties. One specimen is a *racloir sur face plane*. Less common tool types are notches and denticulates, choppers and chopping-tools, as well as fragmentary and complete manuports. Among the cores, several small Levallois examples were noted, similar to the ones described for Dar es-Soltan I. The Aterian character of this industry is reinforced by the presence of tanged pieces (one Levallois flake, two points, of which one is transitional to a *pointe marocaine*, six sidescrapers, and an endscraper). Layers 6 and 7 were not as intensively excavated, but the industries

UNIT	DESCRIPTION (Barton <i>et al.</i> 2009)
G5 (R)A (c.0.65 m)	GROUP 5 – grey stony material (not yet observed in detail).
G5.1-2 (R)B (>2.5 m)	GROUP 5 – midden and fine sand. [G5.2 OSL 16-X2392 and OSL 15-X2391; G5.1 OSL 14-X2390]
G4.1-8 (R)C (c.1.3 m)	GROUP 4 – upper red-brown units, all dense and well consolidated; strong gullyng throughout but especially at the base, apparently water entering from southern and especially the eastern openings; more or less pronounced trough bedding at most levels; very large slabs (up to 0.3–0.4 m thick 1.0–1.5 m long) at all levels in G4 in the back of the cave but then only towards top, and eventually disappearing, westwards out of cave, plausibly derived from the east (collapse eventually leading to the wide opening present today). [G4.7 OSL 13-X2389; G4.1 OSL 12-X2388]
G3.2-13 (R)D (R)E (c.1.4 m)	GROUP 3 – roughly horizontal beds throughout cave (lacking significant cross-dip); across (seen in E-W section) the entrance below the southern opening, gentle domed form (local low talus); darker brown with carbonate beds; common charcoal, true hearth lenses, artefacts; somewhat truncated by gullyng in places. The darker units in G3 (interpreted as dominated by hearths and/or hearth cleanings) are generally cyclic [top: light (ash and carbonate); pink (fired), black (charcoal), dark brown (charcoal flecks and powder), brown (mineral)], the motif being recognisable in any single vertical line but the units appearing as lenses over several metres horizontally. [G3.13 OSL 11-X2387; G3.11 OSL 18-X2394; G3.4 OSL 10-X2386; G3.3 OSL 9-X2385]
G3.1 (R)F (c.0.3 m)	GROUP 3 – carbonate-rich facies. [G3.1 OSL 8-X2384]
G2?.8 (R)G (c.0.1 m)	Possibly GROUP 2; silty sandy loam.
G2.7 (R)G&H (c.0.3 m)	GROUP 2; banded sediments, rising gently into cave (but low amplitude long wavelength wavy); apparently quite strong cross-dip (down to the south or southeast); includes quite strong carbonate layers, some decayed but true discontinuous stalagmite; some charcoal and bone present; truncated by angular unconformity. [G2.7 OSL 7-X2383]
G2.2-6 Mostly (R)I (c.0.4 m)	GROUP 2 - banded sediments, rising into cave (but low amplitude long wavelength wavy); almost horizontal at S3, westerly dip increasing inwards from c.5° to 12°–18°; apparently quite strong cross-dip (down to the south or southeast); includes relatively strong carbonate layers, some decayed but true discontinuous stalagmite; some charcoal and bone present. [G2.6 OSL 6-X2382]
G2.1 (R)J (c.0.5 m)	GROUP 2; banded sediments, rising gently into cave (but low amplitude long wavelength wavy); includes quite strong carbonate layers; some charcoal and bone present. [G2.1 OSL 5A&B-X2380/1]
G1.8-19 (R)K (>0.6 m)	GROUP 1 – well bedded (probably originally laminated at most levels), concreted (harder into cave), strongly variegated units, with common ‘chocolate’ Mn colours, bedded dipping down (12°) towards the west (towards the main entrance); truncated by angular unconformity, dipping down (12°) into cave, itself cemented/welded. [G1.16 OSL 4-X2379; G1.10 OSL 20-X2396; G1.8 OSL 3-X2378]
G1.5-7 (R)L (c.0.6 m)	GROUP 1 – coarser sands (disturbed/reworked upper units). [G1.7 OSL 2-X2377]
G1.1-4 (R)M (>1.1 m)	GROUP 1; coarser sands. [G1.4 OSL 1-X2376; G1.3 OSL 17-X2393]
BEDROCK	[OSL 19-X2395 & OSL 21-X2397]

Table 3.1. The Dar es-Soltan I sequence (the correlation with the Ruhlmann sequence is shown on the left by the ‘(R)’ prefix).

UNIT	DESCRIPTION (transverse section on the left/northeasterly side of the entrance, observer facing 160° magnetic)
7	SNC 2005: siliceous medium to fine coarse sand with bioclastic component and larger shell fragments; looser and rather amorphous lower ("7b") [OSL SOL2-05-01 X2399]; cemented at top ("7a"); appears to be a marine beach, although structural detail (bedding) no longer obvious; bedrock not observed. Debénath 1975: <i>"La couche la plus profonde est constituée de sables coquilliers ; elle renferme une grosse dalle d'effondrement brisée en plusieurs éléments. C'est sous l'un de ces éléments que nous avons mis au jour un nombre important de fragments osseux humains"</i> . Debénath 1978: <i>"Couche 7: la couche 6 passe insensiblement à des sables marins (couche 7) qui repose, dans cette partie de la grotte sur le substratum rocheux (grès dunaire). Ces sables contiennent dans leur partie médiane une grande dalle d'effondrement"</i> .
6	SNC 2005: reddish loam; extreme bioturbation at various scales; no internal stratigraphy or bedding visible; typical Iberomaurusian backed blade observed; appears to be equivalent to (indistinguishable from) Unit 3b2, the intervening Unit 5 being the apparent basis of the original distinction. Debénath 1978: <i>"Couche 6: c'est une couche rougeâtre prise en biseau entre les couches 5 et 7. Elle renferme un mince foyer à sa base"</i> .
5	SNC 2005: pinkish breccia; one or more discrete older blocks reworked into the matrix of Units 6/3b2; contains shell fragments, small charcoal fragments, bone fragments, lithics [OSL SOL2-05-02 X2400]. Debénath 1978: <i>"Couche 5: couche bréchique plus ou moins régulière, principalement visible sur la coupe frontale où on la voit plonger vers le Sud. Elle se subdivise dans la partie Nord et forme ainsi une sorte de poche renfermant un sédiment fin identique à celui constituant la couche 6"</i> .
4	SNC 2005: unseen. Debénath 1978: <i>"Couche 4: elle est constituée par une grande dalle d'effondrement et n'occupe pas toute la surface fouillée."</i>
3 general	Debénath 1978: <i>"Couche 3: couche sableuse rouge, très puissante, se subdivisant localement"</i> .
3b general	Debénath 1978: <i>"Niveau 3b: plus brun que [... 3a], ce niveau renferme une mince lentille cendreuse. La limite entre 3a et 3b est parfois diffuse et difficile à mettre en évidence. Ce niveau est souvent affecté par des ravinelements liés à l'occupation humaine de la couche 2. Dans certaines parties du gisement, il se subdivise"</i> .
3b2	SNC 2005: reddish loam; extreme bioturbation at various scales; no internal stratigraphy or bedding visible [OSL SOL2-05-03 X2401]; appears to be equivalent to (indistinguishable from) Unit 6, the intervening Unit 5 being the apparent basis of the original distinction. Debénath 1978: <i>"3b2: plus rouge [than 3b1], ce niveau ne renferme pratiquement pas de cailloux, mais quelques granules très sporadiques, ainsi que des nodules bréchiques pouvant atteindre une dizaine de centimètres de diamètre."</i>
3b1	SNC 2005: shell midden; strong burrows bring midden material down through the rest of the stratigraphy; obviously derived shell actually stuck (recemented) into the top of Unit 7a in one place. Debénath 1978: <i>"3b1: brun-grisâtre, il ravine le niveau sous-jacent et se caractérise par la présence de quelques éléments caillouteux de petites dimensions"</i> .
3a	SNC 2005: shell midden; probable location of [OSL SOL2-05-04 X2402] in 3a'. Debénath 1978: <i>"Niveau 3a: niveau supérieur renfermant quelques galets brûlés et une lentille cendreuse importante constituant le niveau 3a'"</i> .
2	SNC 2005: shell midden. Debénath 1978 <i>"Couche 2: kjoekkenmoedding très pauvre, atteignant par places plus de 1m d'épaisseur et ravinant parfois la couche sous jacente"</i> .
1	SNC 2005: not observed. Debénath 1978: <i>"Couche 1: remaniée, elle renferme des éléments récents"</i> .

Table 3.2. The Dar es-Soltan II sequence (the descriptions, tabulated here and later in this paper, are combinations of the observations made by one of us (SNC) during visits in 2005 and a selection only of material published after earlier campaigns, sufficient to ensure continuity of reporting).

they contain appear to be identical to that found in layer 5: low Levallois index, importance of scrapers, presence of tanged pieces and choppers.

The Aterian levels also contain many combustion features, the first such structures to be well documented in the Moroccan Aterian, despite previously known instances

of burnt material and recently confirmed instances (seen in section only) of *in situ* burning events at DeS I. Among these features are closed fireplaces, with edges well-defined by the presence of limestone slabs but also open hearths of oval or circular contour, as well as those dug out of the consolidated clayey sediments, and, finally, combustion

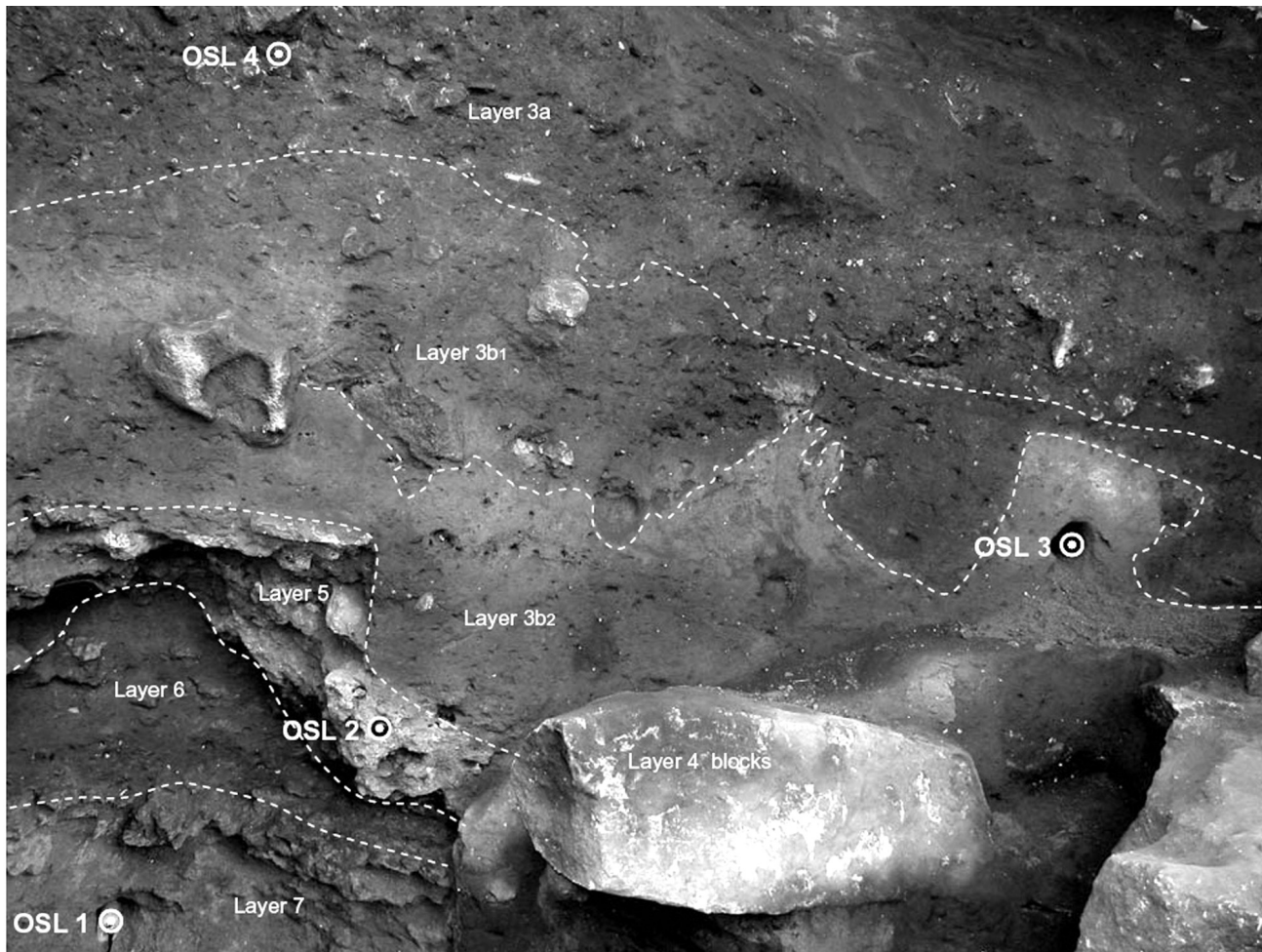


Figure 3.3. Dar es-Soltan II (photographic montage, removing additional rock from foreground).

features with non-delimited edges (El Hajraoui 2004).

Some tools made of bone have been described in El Mnasra (El Hajraoui 1994), though a more detailed study of them is still awaited. This technology is yet not widely understood in Aterian contexts in the cave and elsewhere.

Pigments are represented at El Mnasra by a number of small blocks of hematite found in layer 7 that exhibit several subparallel traces of scraping on both sides of the polished blocks. This is the first documentation of such behaviour within the Aterian. The likely use of colorants is further suggested by a fairly large quartzite nodule (137×128 mm) whose top surface shows a use-related polish in its most concave part. Interestingly, the lateral part of the nodule, 1 to 2 cm wide, shows no modification, but appears to have traces of a dark red pigment.

The basal layers 10, 11, 12 and 13 (subunits “A14” and “A16”) which yielded relatively few diagnostic lithic artefacts have been attributed to the Middle Palaeolithic.

Contrebandiers

The cave of Les Contrebandiers (Fig. 3.1) is located southwest of Témara-Plage on the coastal road leading to Casablanca. It is located at an altitude of c. 14 m and at a distance of c. 270 m from the modern coastline. The site was discovered in 1955 by Jean Roche who carried out a series of excavations until 1975 (Vallois and Roche 1958; Roche 1963, 1969, 1976; Roche and Texier 1976). Further excavations were undertaken by one of the authors in 1994 (Bouzouggar 1997a, 1997b) and a new programme of ongoing research was initiated in 2006 by Harold Dibble from the University of Pennsylvania and Mohamed Abdeljalil El Hajraoui from INSAP, Morocco. Whereas Roche initially only recognised seven archaeological layers, subsequent studies demonstrated more realistic lateral variation across the site, both in unit composition and stratigraphic subdivision. The site stratigraphy and taphonomy are further complicated by the presence of numerous Iberomaurusian

UNIT	DESCRIPTION (sagittal section; cf. Debénath in: Nespoulet and El Hajraoui 2004, Fig. 25; Nespoulet <i>et al.</i> 2008, Fig. 3; Niftah <i>et al.</i> 2005, Fig. 3)
13	[Unit not shown on Fig. 3.4] Niftah <i>et al.</i> 2005: Unit 13, subunit “A17” “[sables]”, “sables grossiers rosâtres”. Niftah <i>et al.</i> 2005: Unit 13, subunit “A16” Major “[aires de combustion]”. Niftah <i>et al.</i> 2005: Unit 13, subunit “A15” “[sables]”, with discrete lenses/patches of “[concrétions carbonatées]”. SNC 2005: Unit 13, subunit “A14” Sandrock (beach rock), relatively fine-medium sand, very well cemented. Niftah <i>et al.</i> 2005: “[sables]” with traces of “[aires de combustion]”; possible erosive base. SNC 2005: Unit 13, subunit “A13” Clayey medium sand (disturbed beach sand), capped by traces of carbonate cementation (in a band some 10-cm thick), subsequently altered to a dark brown colour (Mn-enrichment). Layer 13 (subunit “A13”) continues to 110 cm below the base of Layer 11 in the section sampled. [OSL ELM-05-01 X2413] at 94 cm below the base of Layer 11. Nespoulet & El Hajraoui 2004: “Couche 13: Reconnue sur quelques centimètres, elle semble correspondre à un niveau plus sableux que les précédents.” “[Couche] sableuse.” Niftah <i>et al.</i> 2005: “[sables argileux]”.
12	SNC 2005: Clayey sandy loam, well bedded (laminated), orangey brown in colour. This layer continues to 61 cm below the base of Layer 11 in the section sampled. [OSL ELM-05-02 X2414] at 37 cm below the base of Layer 11. Nespoulet and El Hajraoui 2004: “Couche 12: De couleur brun-jaune sombre (10YR3/4), la couche 12, épaisse de 70 à 80 cm présente une limite nette avec la couche 11.” “[Couche] sableuse.”
11	SNC 2005: Sharp lower boundary (possibly significant unconformity). Nespoulet and El Hajraoui 2004: “Couche 11: La couche 11, épaisse de quelques centimètres, de couleur brune (10 YR 5/6) est de nature voisine de celle des couches 4 et 8.” “[Couche] sablo-argileuse.”
10	Nespoulet and El Hajraoui 2004: “Couche 10: La couche 10 est épaisse de 15 à 20 cm, elle est de couleur brun très sombre (10YR 2/2). Elle renferme des petits nodules de calcarénite.” “[Couche] sableuse.”
9	Nespoulet and El Hajraoui 2004: “Couche 9: Subdivisée en deux niveaux, la couche 9 a une épaisseur maximale de 25 cm dans la zone étudiée. Le niveau 9a est brun jaune sombre (10YR 4/4). Ce niveau a moins d’une dizaine de centimètres d’épaisseur. Le niveau 9b, de couleur gris très sombre (10YR 3/1) n’est visible que sur la coupe frontale du sondage et semble être lenticulaire. Sur la coupe sagittale, la limite 9a-10 est diffuse et souvent difficile à mettre en évidence.” “[Couche] sablo-argileuse.”
8	Nespoulet and El Hajraoui 2004: “Couche 8: Epaisse au maximum de 10 cm, cette couche rappelle la couche 4, elle est de couleur brune (10 YR 5/3) et est composée d’amas jointifs cendreux. Sa limite entre avec les couches 7 et 9 est nette.” “[Couche] sablo-argileuse.”
7	SNC 2005: Level 7b [OSL ELM-05-03 X2415]. Nespoulet and El Hajraoui 2004: “Couche 7: Epaisse d’une vingtaine de centimètres, elle est subdivisée en deux niveaux: 7a et 7b. Constitué par des amas cendreux de couleur brun rouge sombre (5YR 3/3) qui existent dans le carré 8, le niveau 7a [top] sépare 6a de 7b, de couleur brun sombre (7,5 YR 3/4) qui est de nature proche de celle de 6a. Il est souligné localement à sa base par une partie plus sombre, plus riche en cendres. La limite 7a/7b est nette.” “[Couche] sableuse.”
6	Nespoulet and El Hajraoui 2004: “Couche 6: Deux niveaux y ont été individualisés: Niveau 6a [top]: Epais d’une dizaine de centimètres, de couleur brun rouge sombre (5YR 3/4), sa limite avec la couche sus-jacente est nette. Niveau 6b: Epais d’une douzaine de centimètres, sa couleur est proche du précédent (5YR 3/3), il renferme quelques cailloux de calcarénite et se distingue du niveau 6a par une structure plus granuleuse et une texture un peu plus caillouteuse, avec la présence de petits amas de graviers. Il disparaît [inwards] où il ne reste plus qu’une lentille un peu plus noirâtre qui correspond à des cendres.” “[Couche] argileuse.”
5	SNC 2005: Level 5a [OSL ELM-05-04 X2416]. Nespoulet and El Hajraoui 2004: “Couche 5: Subdivisée en 4 niveaux, qui n’existent que localement. Elle est plus cendreuse que les autres niveaux. [Elle] est de couleur brun rouge sombre (5YR 3/2). L’épaisseur de la couche 5 est de l’ordre de 20 à 50 cm. Niveau 5a [top]: Epais d’une quinzaine de centimètres, brun rouge sombre (5YR 3/2), plus cendreuse que le reste de la couche, ce niveau ne contient que très peu de coquilles; sa limite avec 5b est légèrement diffuse. Des passées charbonneuses sont visibles au sein de ce niveau. Niveau 5b [below]: Niveau cendreuse, plus clair que le précédent, brun rouge (5YR 4/2 à 5YR 5 /2). Ce niveau semble disparaître [inwards]. Le contact 5b- 6a est net. Niveaux 5c et 5d [lenses in 5a]: Il s’agit de passées de cendres identiques à celles qui constituent la couche 4 qui s’intercalent localement dans le niveau 5a.” “[Couche] argileuse.”
4	Nespoulet and El Hajraoui 2004: “Couche 4: De couleur jaune brun clair à jaune brun, identique à celle du niveau 3d, avec des passées plus sombres (10YR 4/3), cette couche est d’épaisseur variable [... up to 40 cm]. La couche 4 se présente sous forme d’amas plus ou moins jointifs, dont la limite avec la couche 3 est nette. A la base de la couche, on trouve localement quelques éléments de calcarénite plus ou moins brûlés. La limite entre les couches 4 et 5 est sinueuse, mais particulièrement nette.” “[Couche] sablo-argileuse.” A sparse flake industry (assumed to be Middle Palaeolithic) is reported from this layer.
1-3	Cardial ware is present at the base of these recent units (cf. Nespoulet and El Hajraoui 2004).

Table 3.3. The El Mnasra sequence.

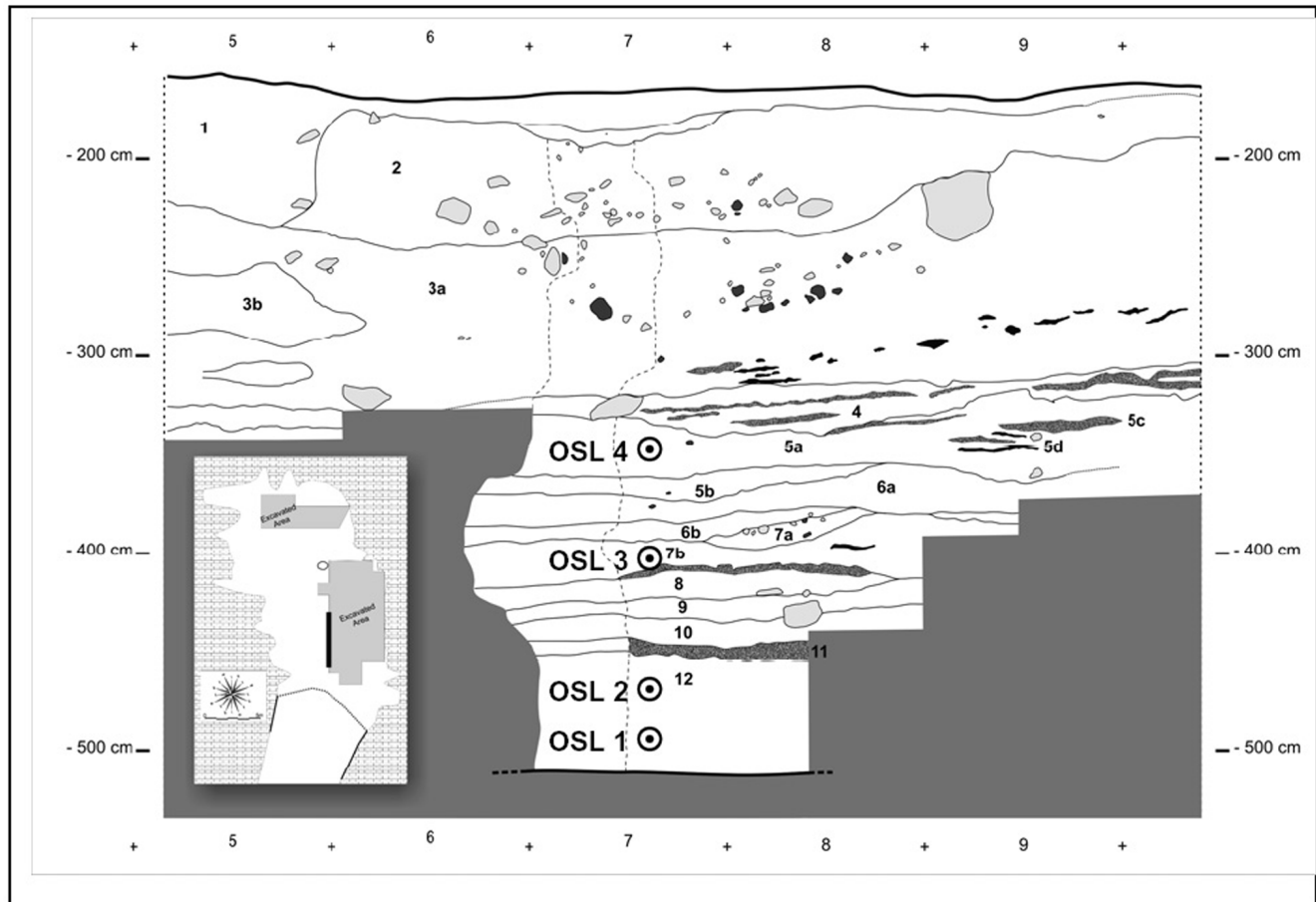


Figure 3.4. El Mnasra (after Nespoulet *et al.* 2008, Fig. 3, with current OSL locations added).

pits which extend into underlying Aterian sedimentary units. The revised sequence proposed by Bouzouggar suggests a more complex stratigraphic sequence comprising 16 layers (see Table 3.4 and Figs. 3.5 and 3.6). Layers 1 to 5 are associated with the Neolithic occupation of the site and are separated from the underlying Iberomaurusian contexts (restricted to layer 7) by a sterile layer (layer 6). Aterian finds occur in layers 8 to (probably) 14 and overlie two basal sandy units (layers 15 and 16). This last unit contains abundant marine shell debris and is presumed to represent an interglacial beach deposit. Radiocarbon dating of samples of bone, shell and sediment was undertaken in the 1970s (Daugas 2002). However, the results are highly inconsistent (Delibrias *et al.* 1982) and the reliability of the dates is very questionable given the difficulties surrounding the dating of such types of material (Occhietti *et al.* 1993) and the absence of modern methods of pre-treatment and analysis (Occhietti *et al.* 2002).

Luminescence dating

Optically stimulated luminescence (OSL) dating provides an estimate of the time elapsed since luminescent minerals, such as quartz or feldspar, were last exposed to sunlight (Huntley *et al.* 1985; Aitken 1998). Light-shielded grains may accumulate charge from the effects of the environmental radiation flux to which they are exposed and the dose received by the sample, also referred to as the palaeodose, can be measured using the luminescence signal. A burial age estimate is obtained by dividing the palaeodose by the environmental dose rate. OSL dating of sedimentary quartz has become a well-established technique within Quaternary science (Duller 2004; Lian and Roberts 2006) and recent applications to archaeological sites in Australia (Prideaux *et al.* 2007), Morocco (Bouzouggar *et al.* 2004–05; Rhodes *et al.* 2006; Mercier *et al.* 2007; Barton *et al.* 2009), Spain (Berger *et al.* 2008), and South Africa (Jacobs *et al.* 2003a, 2003b, 2006, 2008a, 2008b) demonstrate the high potential of optical dating for securing chronological frameworks at cave and rock shelter sites.

UNIT	DESCRIPTION (transverse section, cf. Delibrias and Roche 1976, Fig. 2, Section H-J 21/22; cf. also Fig. 4, Section F-J 20/21 further south)
"16"	SNC 2005: Sandrock (beach rock); artificial distinction with the less cemented (bioturbated and altered) Unit 15. Aeolianite bedrock is not present in the available exposures. Roche and Texier 1976: "16: <i>Croûte avec lentilles sableuses très concrétionnées recouvrant le plancher de la grotte. Ni faune, ni industries. Ce niveau est le vestige de la transgression marine ouljiennne antérieure à l'occupation de la grotte par l'Homme.</i> "
15	SNC 2005: Bioturbated slightly clayey sand (top of beach deposits); stringers of concretions; marine shell still quite apparent; very blotchy colours, 7.5 YR 507/6 with dirty patches; [OSL CON-05-01 X2403]. Roche and Texier 1976: "15: <i>Minces lits de concrétions orangées contenant quelques traces charbonneuses et de la poussière de coquilles. Ni faune, ni industries. Epaisseur: 0,10 m.</i> "
14	SNC 2005: The top of what is assumed to be Unit 14 comprises relatively continuous lenses, concreted hard, containing charcoal; better surviving lenses have light grey interiors (ash?), with charcoal, bone and burnt bone, resembling hearths. There is a dirty, brownish zone, still with some charcoal for another 10 cm below the clear lenses. The bulk of Unit 14 is an originally bedded deposit of clayey sand; sand stringers, some concreted; traces of charcoal; bioturbation has furred the microbedding but this is still just visible; very similar colours to Level 13d. Roche and Texier 1976: "14: <i>Terres sableuses, meubles, brun jaune orangé, contenant quelques lits de concrétions diffuses et des charbons épars. Quelques vestiges de faune mais absence de coquilles. Industrie rare (probablement Atérien). Epaisseur: 0,33 m.</i> "
13d-13a	SNC 2005: Clayey medium to fine coarse sand; shelly in places but mostly recrystallised; the most concreted zones/levels may be due to original shelly sand input (leading to better cementation); perhaps a little stony at the top (cf. Unit 12) further out of the cave; small scale bioturbation; no surviving bedding (other than cemented lenses); a little charcoal in places; 'average' colour 6-7 YR 4/6 with cream speckles and browner blotches. Level 13d (at the base) possibly belongs to Unit 13 (but may relate more closely to Layer 14 below); browner; more charcoal; some bone; traces of burning on underlying surface; 5 YR 3/4; [OSL CON-05-02 X2404]. Level 13c is much cleaner; 7.5 YR 4/6. Level 13a (at the top) is darker, with more charcoal; [OSL CON-05-03 X2405]. Level 13b is just a slightly more concreted lens, more or less laterally continuous. These subdivisions look like the vestiges of primary stratification, all rendered 'fuzzy' by bioturbation. Throughout Unit 13, colours are 'dirty'. Roche and Texier 1976: "13: <i>Sables légèrement argileux jaune rougeâtre. Ni faune, ni industrie. Ce niveau peut être subdivisé en 4 sous-niveaux: a. Terres peu concrétionnées avec traces charbonneuses; b. Lit de petite concrétions; c. Terres peu concrétionnées sans traces charbonneuses; d. Foyers plus ou moins étendus, ne paraissant pas synchrones. La limite inférieure du niveau 13 est nette et ondulée. Epaisseur du niveau 13: de 0,45 à 0,80 m.</i> "
12	SNC 2005: Appears to be the heavily autocemented top of Unit 13 but there may have been increased cementation from drip-water; clayey medium to fine coarse sand. Roche and Texier 1976: "12: <i>Croûte rosâtre contenant quelques coquilles et des traces charbonneuses devenant progressivement en direction de l'entrée de la grotte un système complexe de cordons de brèche entre lesquels sont insérés des blocs d'éboulis. Epaisseur: de 0,05 à 0,35 m.</i> "
11	SNC 2005: Loam; very high level of small scale (1–2 cm diameter) bioturbation, some of which may be penecontemporaneous; completely 'blotchy' aspect, all lenses disjointed/fragmented; many lightly to strongly cemented levels/lenses, probably mostly hearth material but with some additional carbonate (impossible to tell whether this was originally in a stalagmitic or eucladiolith form due to recrystallisation and/or decomposition); clasts often at odd angles due to turbation; common marine shell, bone, artefacts, signs of burning; cemented lenses contain charcoal, lithics, red-ochreous flecks, burnt limestone (aeolianite), shell and bone; ground 5 YR 3/2 and blacker, 5-7/5 YR 4/3, black and orange flecks; concreted levels 7.5 YR 6-7/2-3. [OSL CON-05-04 X2406] at base ("11c"), [OSL CON-05-05 X2407] higher ("11a"). Roche and Texier 1976: "11: <i>Terres argileuses brunes passant progressivement au brun clair. A la partie supérieure, éboulis et concrétions discontinues, s'altérant progressivement. Atérien moyen. Localement, se subdivise en 3 sous-niveaux: a. Terres meubles contenant des éléments caillouteux de dimensions variables; b. Concrétions lenticulaires de couleur plus claire insérées dans la partie centrale du niveau 11; c. Mêmes caractéristiques que 11a. Limite inférieure sinueuse et bien marquée. Epaisseur moyenne du niveau 11; 0,60 m.</i> "
10	SNC 2005: 15-60 cm limestone (aeolianite) blocks, relatively continuous band around most exposures. Roche and Texier 1976: "10: <i>Lits de blocs de grès dunaire. Quelques plaquettes émoussées. Epaisseur: de 0,08 à 0,20 m.</i> "

Table 3.4. The Contrebandiers sequence.

9	SNC 2005: Silt, slightly fine sandy in upper parts but cleaner towards base; dense, uniform; pores due to root penetration but few obvious major burrows; point cementation (samples need to be crushed); some small sharp stones, larger blocks at base; fine shell flecks; terrestrial mollusca (possibly penecontemporary in some cases); bone fragments; 8 YR 6/5, very slightly yellower and less chroma than Unit 8 (boundary best seen by wetting); lower boundary (with fine sediment of Unit 11) shows some convolutions and possible small-scale erosive forms. This is still too sandy to be a true loessic deposit but it does look windblown and 'dusty'. The subdivisions reported by French authors are not obvious but there are gritty lenses over comparatively short lateral distances. [OSL CON-05-06 X2408] and [OSL CON-05-08 X2410] at base. There seems to be a heavily cemented remnant of this Unit inside the central part of the cave, with possible Unit 8 above and clear Unit 11 below. Roche and Texier 1976: "9: <i>Atérien supérieur. Ce niveau se subdivise en 4 sous-niveaux: a. [top] Biseau de petits éléments anguleux. Patella abondantes; b. Couche à plaquettes anguleuses. Patella abondantes; c. Couche à éléments plus petits et plus altérés qu'en a et b; d. Cordons brêcheux au contact di niveau 10. Epaisseur: 0,45 m.</i>"
8	SNC 2005: Pocket of silty to very silty fine sand with finest to fine angular grit and small limestone clasts; some tiny shell fragments throughout but a large amount of completely recrystallised shell (mostly <i>Patella</i>) towards the base; a little matrix cementation; 7.5 YR 6/6 (dries lighter); [OSL CON-05-07 X2409]; upper boundary (observed in more southerly sections) erosive and often in the form of deep 'pockets' of younger material cutting down even as far as Unit 9. Roche and Texier 1976: "8: <i>Terres sableuse, jaune clair. Atérien supérieur. Epaisseur: 0,60 m.</i>"
7	In a different transverse section, slightly further into the cave and nearer its central line (at approximately at H 19/20), an apparent pit-form was noted, cutting (by over 0.5 m) through Layer 8 and locally into Layer 9 [here sampled by OSL CON-05-09 X2411]; high in the apparent fill of this cut were accumulations of marine shell (middens) but the lowest fill (unclear source) was composed of clean sediment [OSL CON-05-10 X2412]. Delibrias and Roche 1976: "<i>terres gris-rosé, brêcheuses [...] fosses creusées dans [Layers 8 and 9]</i>".
Upper Levels	No longer present in the exterior sections described; " <i>Epipaléolithique</i> " (Iberomaurusian) and later industries reported.

Table 3.4 contd. The Contrebandiers sequence.

Methodology

Luminescence dating was based on quartz grains extracted from a series of forty samples collected by the authors in 2005 from sections exposed by previous archaeological excavations within the caves. All sample preparations took place under low intensity safe-lighting provided by filtered sodium or LED lamps (emitting at ~588 nm) at the Luminescence Dating Laboratory of the Research Laboratory for Archaeology and the History of Art, University of Oxford. Laboratory procedures were designed to yield clean, sand-sized (180–250 µm) grains of quartz for optical dating according to standard preparation methods, including wet sieving, HCl acid digestion, heavy liquid flotation (sodium polytungstate) and etching in 68% HF acid to dissolve potassium feldspar minerals and to clean and remove the outer alpha-dosed layer of quartz grains. The latter residual grains were re-sieved to the original grain size range and mounted as multi-grain mono-layers of c. 3 mm diameter onto new pristine 10 mm aluminium discs using a silicone oil adhesive. OSL measurements were conducted using automated Risø luminescence readers (Bøtter-Jensen 1988, 1997; Bøtter-Jensen *et al.* 2000) and are based on conventional single-aliquot regeneration (SAR) measurement protocols (Murray and Wintle 2000; Wintle and Murray 2006). Palaeodose estimates were obtained for small sized aliquots comprising circa 50 to 150 grains and 6 to 18 repeat

measurements were made for each sample. Optical stimulation for single aliquots was provided by clusters of blue light emitting diodes (42 Nichia 470Δ20 nm) providing a sample stimulation power of ~32–36 mW cm⁻². The natural and regenerative doses were preheated at 260°C for 10 s, and the fixed test doses (which are used to correct for any sensitivity changes) were preheated at a reduced temperature of 240°C for 10 s, before optical stimulation. The absence of infrared-sensitive minerals (e.g., feldspars) was checked and confirmed using an infrared bleach provided by a solid state laser diode (830Δ10 nm; 1 W cm²) at 50°C for 100 s before blue or green-light stimulation. The ultraviolet OSL emission at ~370 nm was detected using an Electron Tubes Ltd 9235QA photomultiplier tube fitted with a blue-green sensitive bialkali photocathode and either 7.5 mm of Hoya U-340 glass filter or two Corning U-340 glass filters. Laboratory doses used for constructing dose response curves were given using a calibrated ⁹⁰Sr/⁹⁰Y beta source housed within the reader.

The environmental gamma and beta components of the dose rate result from the radioactive decay series of ²³⁸U, ²³²Th and ⁴⁰K within the sediment. We combined the results of in situ γ-ray spectroscopy measurements with concentrations of these parent isotopes within the sediment derived by inductively coupled plasma mass spectroscopy (ICP-MS) using a lithium metaborate/tetraborate fusion. A portable

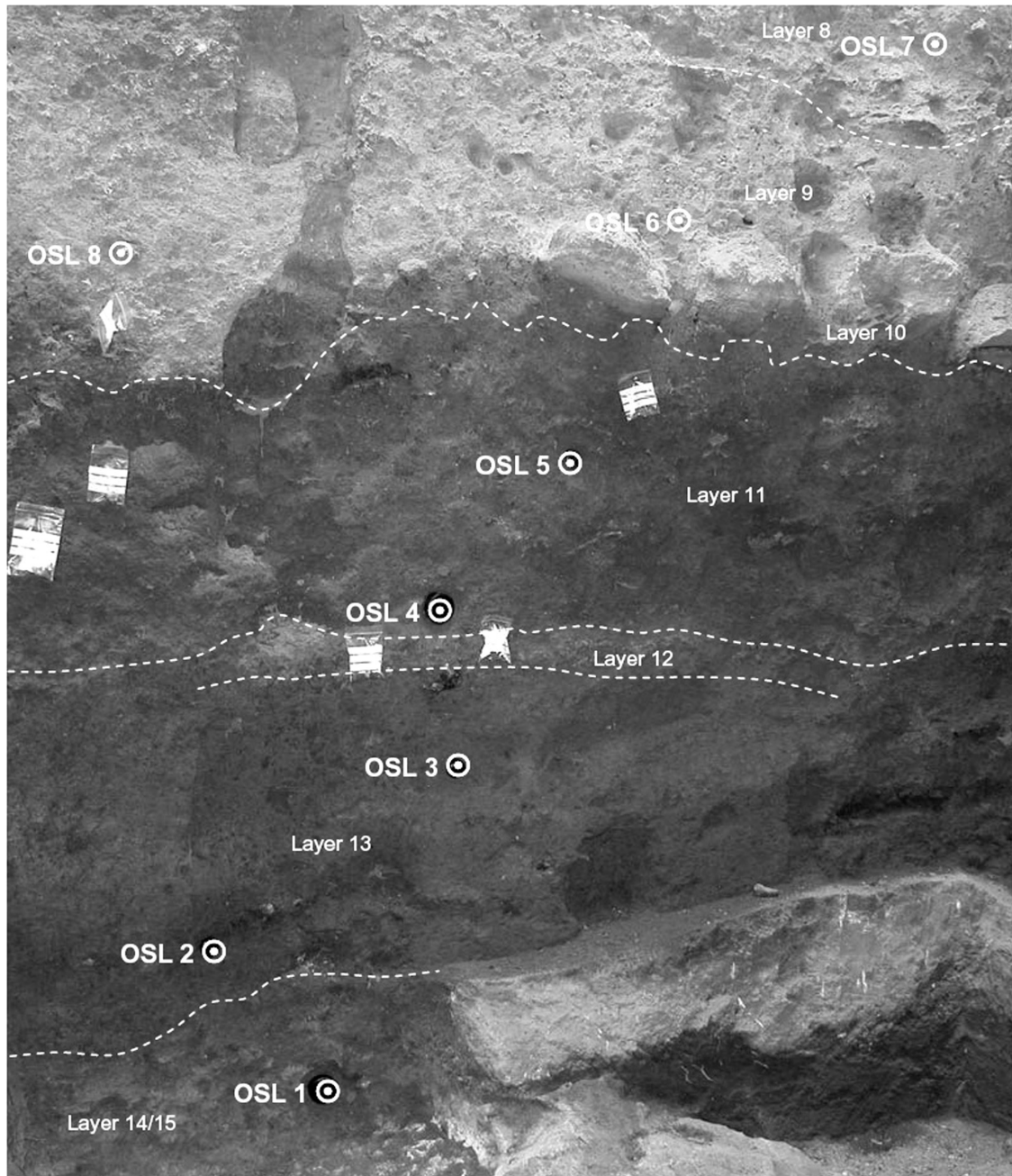


Figure 3.5. Les Contrebandiers (Section HJ 21/22, looking outwards).

gamma-ray spectrometer (Ortec Micromomad multi channel analyser equipped with a 3×3 inch NaI (Tl) scintillator crystal) was employed in a 4π -geometry and calibrated against the Oxford calibration blocks (Rhodes and Schwenninger 2007). These on-site measurements provided direct estimation of the in-situ environmental gamma radiation field. The beta dose rate was derived from the measured concentrations of parent isotopes. These were

converted to dose rates according to attenuation factors proposed by Adamiec and Aitken (1998), using corrections for grain size (Mejdahl 1979) and water content (Zimmermann 1971).

The cosmic-ray dose was calculated according to standard data reported by Prescott and Hutton (1994), taking into account the height and density of the overburden (including the thickness of the cave roof), as well as the

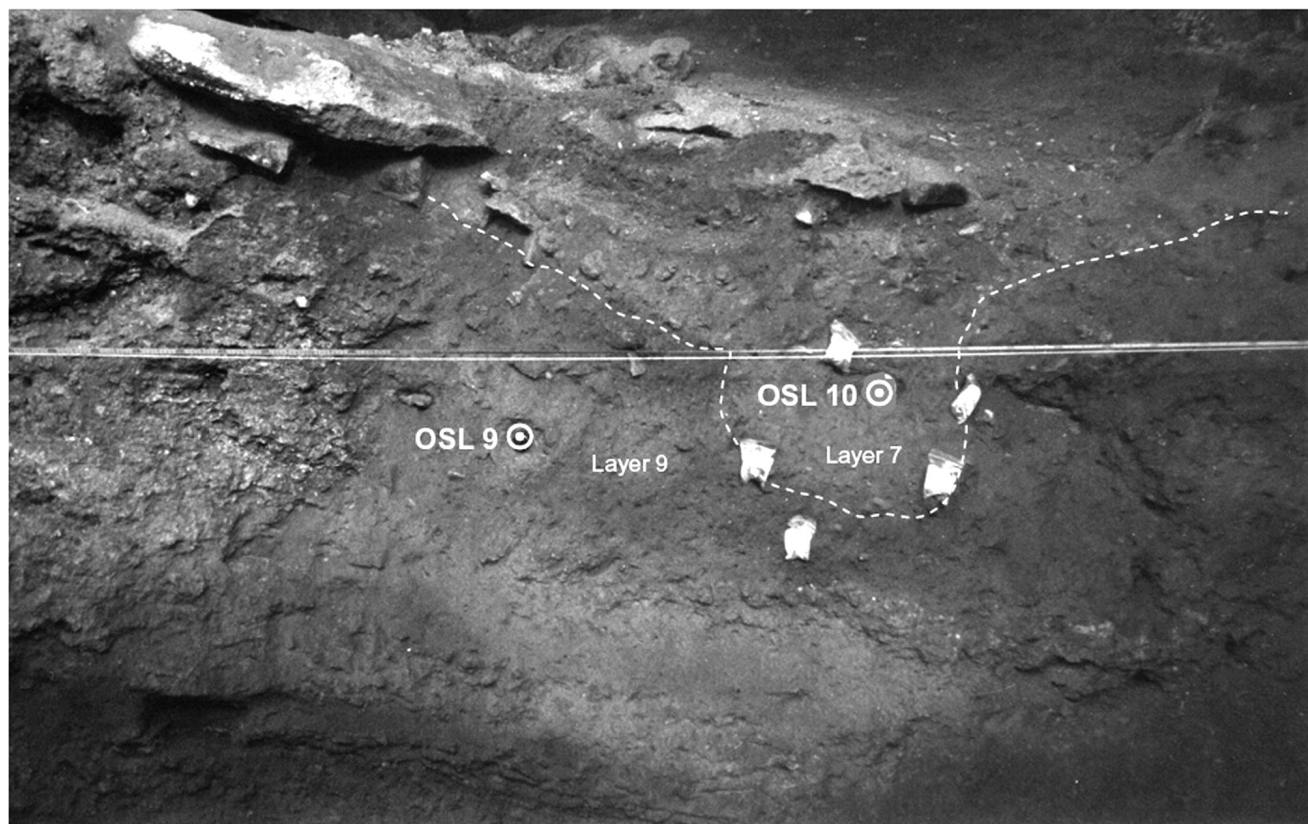


Figure 3.6. Les Contrebandiers (Section approximately H 19/20, looking inwards).

geomagnetic latitude and surface altitude of the site. The past water content of the sediments may at times have deviated from the modern field values but none of the samples were located near a drip line nor are they believed to have been fully saturated for prolonged periods of time (relative to the total burial time). The present moisture contents may therefore be considered to represent the best approximation of the average water content of the samples throughout their burial history. To accommodate any significant attenuation effects caused by past changes in pore water on the total dose rate received by the quartz mineral grains, relatively large systematic errors were attached to individual values.

OSL results

Multi-grain palaeodoses were determined from the first two seconds of OSL, using the final ten seconds as background noise. Dose-response curves were fitted using a saturating-exponential-plus-linear function, with the standard error on the palaeodose determined by Monte Carlo simulation (1000 iterations) or using a weighted linear fitting procedure based on propagation of all measurement errors. A systematic laboratory reproducibility uncertainty of two percent was

added to each OSL measurement error to account for uncertainties in the calibration of the beta source.

Few aliquots showed signs of feldspar contamination suggesting high sample purity and thereby confirming good sample preparation and/or relative sparseness of feldspathic components amongst the mineral components of the various cave infills. The majority of multi-grain single aliquots studied here displayed high sensitivity and the shine down curves typically show a strong and fast decreasing OSL signal. Most samples also provided a well defined 110°C TL peak which is characteristic of quartz. Routine repeat measurements of the luminescence signal resulting from the first regeneration dose (recycling test) indicate that the adopted SAR procedure provides adequate correction for changes in the sensitivity. Samples are generally characterised by excellent recycling ratios with mean values typically in the range of 0.97 to 1.02 (close to unity). The same is also true for recuperation (Aitken and Smith 1988) which is generally below 1% as monitored by the OSL response after a regeneration dose of zero. This index falls well below the 5% mark suggested for the SAR thermal transfer test proposed by Murray and Wintle (2000).

The measured SAR palaeodose values and the calculated

OSL age estimates are shown in Table 3.5. With the exception of sample X2395 from Dar es-Soltan I, which was deliberately collected from the soft and severely weathered outer rim of a large boulder fallen from the roof of the cave, the dates are considered to be reliable. The fact that they generally are in stratigraphic order, provides additional reassurance that the majority of mineral grains were bleached before deposition. As noted in Barton *et al.* (2009), sample X2395 has a suspicious high uranium content of 7.4 ppm compared to the other samples in the series. This could be related to post-depositional concentration of uranium following chemical weathering processes around the edges of the boulder. An erroneous high dose rate could be responsible for a serious age underestimate and for this reason, this date should not be considered to be reliable.

Despite potential difficulties with individual samples from some of the sites, the overall good characteristics of the luminescence signal of most of the cave sediments studied here as well as the relatively consistent set of results which emerge from the dating of samples collected from similar depositional contexts at different sites suggest that a reliable chronological framework of cave sedimentation and human occupation can be achieved. Given the relatively large number of samples collected at Dar es-Soltan I and their secure stratigraphic relationship, a Bayesian model was constructed for this series of samples in order to further improve the resolution of the OSL based chronology. Further details and results of this analysis may be found in Barton *et al.* (2009). Since an accurate geodesic datum is not currently available in the immediate vicinity of that cave,¹ we have taken the primary marine planation bench (or, more exactly, the surface of the retained water basin exposed during low tide, but well covered during high tide, at 33°58'51.6"N, 6°53'54.8" W) as a reasonable surrogate (within about one metre accuracy using GPS) for mean sea level, a datum which we label as '≈msl'.

Discussion

The new dating evidence has major implications for understanding the complex stratigraphy of cave sediments in the area as well as the related Aterian finds. To begin with, Plaziat *et al.* (2008) recognise, in the Rabat to Casablanca coastal zone (flanking the inland Meseta), an epirogenic regime involving limited uplift likely to register all the major eustatic variations of sea level in the Quaternary (although they also note the possibility of a minor subsidence phase between Marine Isotope Stages 5 and 1). Bargach *et al.* (2004) found that, whilst neotectonics effects may be very significant both north and south of this zone, deformation in the southernmost edge of the foreland basin and in the foreland itself (represented by the Gharb basin and Meseta in the area of Rabat) is weaker, the stress field (involving sets of orthogonal tension joints, with some

normal and transcurrent faults of increasing significance southwards) is generally characterised by radial extension, with permutations and progressive variations of the trend of extension in close outcrops.

True intertidal sands have so far been proven beyond doubt only at Dar es-Soltan I, where they have been attributed to the Ouljian highstand of MIS 5e (cf. the detailed discussion in Barton *et al.* 2009). Since an accurate geodesic datum is not currently available in the immediate vicinity of that cave, we have taken the primary marine planation bench (or, more exactly, the surface of the retained water basin exposed during low tide but well covered during high tide, at 33°58'51.6"N, 6°53'54.8"W) as a reasonable surrogate (within about one metre accuracy using GPS) for mean sea level, a datum which we label as '≈msl'. On this basis, the DeS I intertidal deposits reach 4.07 m ≈msl. Coarser sands at the base of the sequences at the other caves in this study could represent similar facies or they may be 'sandrock' (material cemented just above the high tide mark) or even proximal aeolian and/or storm units deposited at the very top of the 'beach'. Using the same geomorphological feature (water basin at 33°55'53.0"N, 6°57'16.0"W) as a zero datum, the altitude of the top subunit "A17" of layer 13 at El Mnasra would be approximately 10 m ≈msl. This range suggests that it will be necessary in the future to consider the lateral (geographic) dimensions as well as the simple vertical (stratigraphic) one in meaningful comparisons between the various cave sequences. Indeed, the next (older) expected highstand cannot be far removed; at El Mnasra, 'stray' shell finds have shown unexpectedly high racemisation (e.g., an instance of a ratio of 0.7 in Layer 4), interpreted by Occhietti *et al.* (2002) as due to human import but possibly also indicating physical proximity to (even a mixed lag within) the cave of MIS 7 beach material.

Table 3.6 shows MIS (sub-)stages together with a possible correlation between the four cave sites which have been sampled for OSL dating during the present project. The deposits attributed to MIS 5.5 and 5.3 at Dar es-Soltan I, Contrebandiers and El Mnasra show close similarities in sequences and sedimentary styles in support of the OSL chronology; the restricted observations of the truncated sequence at the mouth of Dar es-Soltan II are not inconsistent. MIS 5.1 appears to be well represented only at Dar es-Soltan I. Indeed, the bulk of the sediments in the three main caves must have been deposited during the various sub-stages of MIS 5. At Dar es-Soltan I the ratio of MIS 5 to MIS 4-2 sediments is 5.3:2.26 (2.3:1), at Contrebandiers it is approximately 3.13:c. 1.4 (2.2:1) and at El Mnasra it is 2.63:1.05 (2.5:1). These MIS 5 sediments show a number of features (persistent lamination, significant clay mineral content, penecontemporary ichnofossils, minor speleothems and eucladioliths (derived phyto-concretions)) suggesting significant humidity on a seasonal basis if not year-round.

Sample Field code	Sample Laboratory code	Radioisotopes [†]			Field water %	External γ -dose rate [§] (Gy/ka)	Total dose rate (Gy/ka)	Palaeodose (Gy)	Age (ka)
		K %	Th ppm	U ppm					
Dar es-Soltan I									
SOLI/05-01	X2376	0.07	0.5	1.1	2–8	0.244 ± 0.012	0.49 ± 0.02	74.08 ± 3.20	151.4 ± 9.1
SOLI/05-02	X2377	0.36	2.2	1.4	9–19	0.294 ± 0.015	0.76 ± 0.04	84.73 ± 4.25	112.1 ± 8.1
SOLI/05-03	X2378	0.45	2.7	1.0	16–26	0.315 ± 0.031	0.76 ± 0.04	86.38 ± 5.00	113.9 ± 9.7
SOLI/05-04	X2379	0.34	2.5	1.2	19–29	0.335 ± 0.017	0.72 ± 0.03	113.82 ± 7.51	157.5 ± 12.8
SOLI/05-05A [‡]	X2380	0.60	4.3	1.5	11–21	0.433 ± 0.022	1.08 ± 0.05	115.23 ± 4.93	107.1 ± 7.3
SOLI/05-05B [‡]	X2381	0.66	5.4	1.7	11–21	0.433 ± 0.022	1.15 ± 0.06	126.33 ± 8.94	109.9 ± 9.8
SOLI/05-06	X2382	0.63	3.5	1.9	13–23	0.513 ± 0.026	1.18 ± 0.06	145.65 ± 7.84	122.9 ± 9.1
SOLI/05-07	X2383	0.51	4.7	1.6	14–24	0.401 ± 0.020	0.99 ± 0.05	110.67 ± 8.24	111.9 ± 10.1
SOLI/05-08	X2384	1.45	4.0	1.7	9–19	0.692 ± 0.035	1.88 ± 0.11	147.62 ± 6.07	78.4 ± 5.7
SOLI/05-09	X2385	1.25	3.9	1.9	15–25	0.638 ± 0.032	1.65 ± 0.09	147.50 ± 6.26	89.5 ± 6.4
SOLI/05-10	X2386	1.44	4.1	1.9	10–20	0.676 ± 0.034	1.87 ± 0.11	166.28 ± 4.69	88.7 ± 5.9
SOLI/05-11	X2387	1.45	4.7	2.1	10–20	0.686 ± 0.034	1.92 ± 0.11	140.01 ± 7.88	72.8 ± 6.0
SOLI/05-12	X2388	1.16	4.3	1.7	12–22	0.552 ± 0.028	1.55 ± 0.09	95.44 ± 3.97	61.7 ± 4.4
SOLI/05-13	X2389	1.02	4.8	1.8	9–19	0.548 ± 0.027	1.53 ± 0.08	80.51 ± 1.56	52.8 ± 3.2
SOLI/05-14	X2390	0.71	3.6	1.6	3–9	0.499 ± 0.025	1.33 ± 0.06	43.99 ± 2.32	33.0 ± 2.3
SOLI/05-15	X2391	0.57	3.5	1.4	2–8	0.444 ± 0.022	1.17 ± 0.05	8.98 ± 0.45	7.6 ± 0.5
SOLI/05-16	X2392	0.38	2.3	1.0	9–19	0.212 ± 0.011	0.71 ± 0.03	4.82 ± 0.10	6.8 ± 0.4
SOLI/05-17	X2393	0.20	1.3	1.3	9–19	0.200 ± 0.010	0.54 ± 0.02	70.35 ± 8.80	131.4 ± 17.7
SOLI/05-18	X2394	1.23	3.8	1.4	9–19	0.645 ± 0.032	1.68 ± 0.09	113.47 ± 5.90	67.7 ± 5.3
SOLI/05-19	X2395	1.28	1.7	7.4	16–26	0.749 ± 0.037	2.24 ± 0.12	348.34 ± 24.76	(155.5 ± 14.2)
SOLI/05-20	X2396	0.35	2.6	0.8	31–41	0.300 ± 0.015	0.60 ± 0.02	84.39 ± 5.04	139.8 ± 10.5
SOLI/05-21	X2397	0.23	0.7	1.9	0–6	0.345 ± 0.050	0.93 ± 0.07	193.79 ± 23.30	209.2 ± 29.5
Dar es-Soltan II									
SOLII/05-01	X2399	0.20	1.4	1.2	5–15	0.197 ± 0.010	0.59 ± 0.03	71.40 ± 3.56	121.7 ± 8.2
SOLII/05-02	X2400	0.46	3.6	1.3	13–19	<i>n/a</i>	0.92 ± 0.05	93.09 ± 8.85	101.4 ± 11.1
SOLII/05-03	X2401	0.65	4.9	1.9	7–17	0.474 ± 0.024	1.28 ± 0.06	39.88 ± 1.83	31.1 ± 2.1
SOLII/05-04	X2402	0.46	2.6	1.2	5–15	0.304 ± 0.015	0.90 ± 0.04	12.09 ± 0.27	13.4 ± 0.7
Les Contrebandiers									
CON/05-01	X2403	0.34	2.1	1.5	6–16	0.290 ± 0.015	0.80 ± 0.04	103.00 ± 2.22	129.0 ± 6.6
CON/05-02	X2404	0.48	3.6	1.3	12–22	0.352 ± 0.018	0.94 ± 0.04	114.65 ± 11.81	121.8 ± 13.8
CON/05-03	X2405	0.50	3.5	1.9	8–18	0.352 ± 0.018	1.02 ± 0.05	102.60 ± 9.00	100.4 ± 10.3
CON/05-04	X2406	0.34	2.0	1.5	10–20	0.266 ± 0.013	0.76 ± 0.04	79.74 ± 4.72	104.5 ± 7.8
CON/05-05	X2407	0.43	2.5	1.6	14–24	0.253 ± 0.013	0.93 ± 0.07	84.82 ± 6.92	105.8 ± 10.0
CON/05-06	X2408	0.40	2.3	1.3	3–9	0.282 ± 0.014	0.93 ± 0.07	86.85 ± 6.32	100.1 ± 8.4
CON/05-07	X2409	0.37	2.2	1.3	5–11	<i>n/a</i>	0.87 ± 0.06	51.73 ± 8.21	59.4 ± 10.2
CON/05-08	X2410	0.47	3.7	1.5	5–11	0.374 ± 0.019	1.06 ± 0.04	105.10 ± 10.34	99.3 ± 10.6
CON/05-09	X2411	0.37	2.2	1.3	14–24	0.286 ± 0.014	0.76 ± 0.04	73.00 ± 10.04	96.1 ± 14.0
CON/05-10	X2412	0.49	2.6	2.3	7–17	0.355 ± 0.018	1.06 ± 0.05	74.21 ± 1.54	70.1 ± 3.8
El Mnasra									
ELM/05-01	X2413	0.14	1.3	1.7	7–17	0.290 ± 0.014	0.68 ± 0.03	80.58 ± 13.20	118.6 ± 20.1
ELM/05-02	X2414	0.58	4.2	1.6	15–25	0.353 ± 0.018	1.00 ± 0.05	111.28 ± 4.09	111.5 ± 6.9
ELM/05-03	X2415	0.64	4.2	1.3	15–25	0.334 ± 0.017	1.00 ± 0.05	107.06 ± 7.73	107.6 ± 9.6
ELM/05-04	X2416	0.47	3.0	1.0	11–21	0.318 ± 0.016	0.87 ± 0.04	91.79 ± 9.38	105.5 ± 12.0

[†] Measurements were made on dried, homogenised and powdered material by ICP-MS with an assigned systematic uncertainty of ± 5%. Dry beta dose rates calculated from these activities were adjusted for the measured field water content expressed as a percentage of the wet mass of the sample.

[‡] Samples X2380 and X2381 are near replicates taken from the same stratigraphic unit and located within 15 cm horizontal distance of each other. γ -ray spectroscopy measurements were made at the location of X2381 and the same external gamma dose rate was applied to sample X2380.

[§] Based on in-situ measurements using a portable γ -ray spectrometer equipped with a 3x3 inch NaI (TI) scintillator crystal and calibrated against the Oxford calibration blocks (Rhodes and Schwenninger 2007). No field spectroscopy measurements are available for samples X2378, X2396, X2400 and X2409. For the former two we used values based on the mean external γ -dose rate of directly underlying and overlying samples whereas for the latter two, the γ -dose rate was derived from the concentrations of radioisotopes as determined by laboratory based ICP-MS analysis.

Table 3.5. Dose rates, palaeodose values and calculated age estimates. Values highlighted in italics may be problematic and age estimates inserted in brackets are considered to be unreliable. Data relating to samples from Dar es-Soltan I [X2376 to X2397] are reproduced from Table 3 in Barton *et al.* (2009).

MIS	DeS I	DeS II	Contrebandiers	El Mnasra
5.5	G1 (144–123 ka)	Layer 7 (121 ka)	Layer 15 (129 ka) Layer 14 (main part)	?Layer 13, submits “A17” to “A15”
5.4	strong erosion	(disturbance)	(poor exposure)	Layer 13 ?base of submit “A14”
5.3	G2 (119–106 ka)	Layer 5 (101 ka)	Layer 14 (top) to Layer 11 (121–100 ka)	Top layer 13 (118 ka) Layers 12 to 5a (111–105 ka)
5.2	(no obvious evidence)	(disturbance)	?Layer 9 (100–96 ka)	
5.1	G3 (87–68 ka)		(no obvious evidence)	
4	erosion at base G4 (61–52 ka)		Layer 8 (59 ka)	erosion at base (undated) ?Layer 4
3	G5 (base unit 14) (33 ka)	Layer 3b2 (31 ka)		
2	G5 (main unit 14)	Layer 3a (13 ka)	?Upper Layer 7 etc.	
1	G5 (units 15–16) (7–6 ka)			?Layers 3–1

Table 3.6. Proposed correlation of stratigraphic units between different Aterian cave sites of the Témara region. The unmodified central OSL age estimates are shown in brackets.

This is consistent with the reported mammal faunas (in Contrebandiers cf. Reed *et al.* 2008, and in El Mnasra cf. Nespoulet *et al.* 2008), which imply rich grassland with woodland and scrub, but also with some more heavily wooded and some wetland/lacustrine habitats. Similarly, there is a lack of (final-stage) aeolian features and a predominance of marine features reported by Niftah *et al.* (2005) on the basis of SEM analysis of the surfaces of sand grains from caves of this area (*e.g.*, Contrebandiers and El Mnasra).

It is noteworthy that the strong sediment input trapped in cave sequences during MIS 5 in this area seems to be in stark contrast to the situation in many of the open-air sequences reported from southern Morocco. For instance, Weisrock *et al.* (2006), describing fluvial sequences in the Oued Noun, have been able to demonstrate no certain MIS 5 or 4 sediments (other than a basal coarse lag that may be this old), the bulk of this material dating from the period 56–19 ka BP, with the main peak during the later part of MIS 3 (40–30 ka BP). It is currently unclear whether the yield divergence in comparison to the cave situation might be due to differing sedimentary and topographical setting or to the latitudinal (and thus possibly palaeoclimatic) separation (the Oued Noun study area being 4–5° further south). However modest in volume, the actual nature of those cave sediments (especially at Dar es-Soltan I and Contrebandiers) thought to date from ‘cooler’ intervals do involve silts (of possible aeolian origin, especially when occurring in almost pure lenses), perhaps related to increased aridity, cut by localised erosion events, possibly indicative of occasional flooding at times of unstable vegetation cover

(so-called ‘rhexistatic’ conditions). It is to be hoped that, in due course, more geographically oriented studies will take into account the wider surroundings of the caves (cf. the Middle Palaeolithic artefacts noted by Barton *et al.* 2009 in the open-air loams within the dune slack in front of the Dar es-Soltan caves), perhaps eventually linking with work on the fluvial systems reaching the coast near both Rabat and Casablanca.

From an archaeological perspective, the new dates on Aterian cave sites presented here and the recent reassessment of the stratigraphic sequence at Dar es-Soltan I clearly indicate the human presence in the Témara region of western Morocco from soon after 125 ka BP. Artefact-bearing deposits within the four caves reported here (Dar es-Soltan I and II, Contrebandiers and El Mnasra) rest almost immediately on top of marine beach sands which are identified with MIS 5.1. However, in the current absence of diagnostic tools, it remains difficult to attribute these lowermost artefacts specifically to the Aterian. At Dar es-Soltan I, the first unambiguous evidence for this industry comes from the artefacts in Ruhlmann’s Layer I, which we correlate with our sub-units G2 (2–6). This is also confirmed by the discovery in 2005 of a typical pedunculate point in the section from within this part of the sequence. The artefacts in these sub-units can be dated by sample X2382 and are bracketed by dates provided for X2383, X2380 and X2381. In combination these would place the oldest Aterian within the post-maximum stages of MIS 5.

The new OSL chronology has profound implications for understanding the Middle Palaeolithic because the Aterian in the Atlantic area between Rabat and Témara was once

considered to be represented only by its middle and late phases (Roche 1969; Camps 1974; Roche and Texier 1976). It now seems that the technology is considerably earlier in this part of Morocco than previously suspected and older too perhaps than in Tunisia and parts of the Libyan Sahara or on its northern fringes. Recent discoveries have also demonstrated the presence of symbolic ornaments such as shell beads (Bouzouggar *et al.* 2007) and other cultural novelties in the Aterian. On present evidence it implies therefore that these developments may have happened in north-western Africa some time before they did in other more traditionally accepted centres of southern and eastern parts of the continent. Indeed, it has even been suggested by some authors (Richter 2010) that dates for Ifri n'Ammar in eastern Morocco may be the equivalent of MIS 6 age; this site is believed to have alternations between 'Aterian' and 'Mousterian' assemblages in the dated lower levels, fuelling the debate over how to define the difference (if any) between the lithics component of these 'industries'. This in turn suggests that a fuller reappraisal is now required of the timing and interpretation of earliest behavioural innovations linked with the dispersal of modern humans. The occurrence of the Aterian in north-western Africa at least as early as the MIS 5 maximum also challenges the notion that technological, ecological and social changes were principally a response to rapid climatic and environmental changes merely 80–70 ka BP (Mellars 2006). Our evidence would indicate that such developments began earlier and were not just restricted in their geographical spread to sub-Saharan Africa.

The implications of the new optical dating evidence are not only far reaching for the human occupation of the region. As noted by Barton *et al.* (2009), Dar es-Soltan I is the type site for the Soltanian but the boundary of this chronozone with the underlying Ouljian is still unresolved, even in MIS terms. Some authors place MIS 5.1–4 in the Ouljian (cf. Stearns 1978; Texier *et al.* 2002; Rhodes *et al.* 2006), whilst others leave these sub-stages out altogether (cf. Occhietti *et al.* 2002). There would seem to be an equally strong argument for placing in the Soltanian what will usually be, in surviving exposures (including those at Dar es-Soltan I), 'continental' deposits.

Conclusion

Until now there has been continual underestimation of the age of the bulk of the (younger) cave sequences in the Rabat-Casablanca area. This was perhaps due to dependence upon less reliable dating methods, such as early radiocarbon assay on bone, shell and charcoal, or uranium-series determinations on shell (Delibrias *et al.* 1982). Relative dating schemes were understandably limited by the nature of the techniques used (*e.g.*, amino-acid racemisation phasing; cf. Occhietti *et al.* 2002). This inevitably reinforced

the 'short' chronology for the Aterian, so much so that, by inadvertent circular reasoning, this archaeological cultural assemblage became a 'marker' for the period. Niftah *et al.* (2005) had no evidence to avoid correlating the main (mostly Aterian) units of the El Mnasra and Contrebandiers sequences with MIS 3 and 2, which also led them to misdate the calcarenite bedrock formation (as itself 'Ouljian') and to misinterpret the subsequent karstic evolution. Synthetic works on the Moroccan Quaternary (*e.g.*, Plaziat *et al.* 2008) are unfortunately still reporting this 'telescoped' archaeological chronology.

The new OSL dates provide a much needed framework for resolving many of the chronostratigraphic questions left open by earlier research at these well-known cave sites and, in particular, in relation to identifying the timing of Aterian occupation in this region. The generally very high quality of the stratigraphic, palaeoenvironmental and archaeological records in these caves (cf. Nespoulet *et al.* 2008) will allow a much better understanding of what we suspect will be the early part of the Aterian, and thus of emerging modern behaviour in humans, at least in this part of Africa. Further work including more advanced single grain OS2 dating is in progress and it is hoped that the 'long' chronology reported here for the cave sequences of the Moroccan Atlantic coast will help to open a new chapter in the study of the dispersal, environmental adaptation and cultural development of anatomically modern humans in north-western Africa.

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Note

1. El Hajraoui, Nespoulet and Debénath have been able to identify a benchmark on the wall of the *ceinture verte* (fixed boundary between vegetation and coastal dunes) in proximity to the El Harhoura 2 Cave (another site in the Témara group). The altitude of this NGM (*Nivellement Général du Maroc*) Mark No. 14 has allowed the zero datum at this cave to be defined with high precision and, following direct EDM survey outwards, the equivalent data in the relatively nearby caves of El Mnasra and Contrebandiers. Thus, the altitude of OSL sample ELM-05-01 (in Layer 13, 0.94 m below the base of Layer 11) from El Mnasra is +16.17 m NGM. At El Mnasra, one notes the apparent 'discrepancy' of 6 m between the value gained by survey to a

benchmark and (slightly less accurate) GPS survey to a specific geomorphological feature. However, the wider significance of the 'numerical' values for altitude is not yet clear, since past published research in the region has never included explicit definition of the altitudinal data used, rendering the distinction between absolute and relative altitudes difficult in many cases. The most important conclusion here is certainly relative, in that the highest altitude of direct marine influence at El Mnasra and Contrebandiers appears similar (from EDM survey) and the same characteristic also appears broadly similar between El Mnasra and Dar es-Soltan I (from GPS survey). In the case of Dar es-Soltan I, the original theodolite survey by Ruhlmann and the 2008 EDM survey by Bouzouggar, each locally between cave and foreshore, confirm the sufficient accuracy of the GPS approach at that location (and, by implication, at El Mnasra, checked using two different GPS units). Whilst there appears to be sufficient altimetric evidence to support the broad thesis concerning the high sea-level stand of MIS 5 in this region set out in the present paper, it is clear that a full and detailed re-survey, at high precision and accuracy, encompassing all the key Quaternary sites (caves and open-air locations, especially ones relating to the raised shoreline morphostratigraphy) would greatly aid future research – as, of course, would improved chronometric fixes for these marker deposits.

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The Spread of Aterian Peoples in North Africa

Elena A. A. Garcea

The conceptual revolution of African prehistory

Neanderthal peoples never existed in the African continent and anatomically modern humans were living in Africa at the same time, and before, Neanderthals settled in Europe and in the Near and Middle East. This does not imply that North Africa did not have a Middle Palaeolithic. Modern humans did not instantly invent Upper Palaeolithic technologies and adopt Upper Palaeolithic behaviours as soon as they evolved in the African continent. There are specific and more appropriate terms that better apply to African prehistory, which are *Early Stone Age (ESA)*, *Middle Stone Age (MSA)* and *Later Stone Age (LSA)*, even though European-based terms like Middle Palaeolithic and Mousterian are still occasionally used to describe North African industries. Grossly speaking, the ESA corresponds to the Lower Palaeolithic in Europe, the MSA to the Middle Palaeolithic, but is associated with anatomically modern humans, and the LSA to the Upper Palaeolithic. African nomenclature is generally preferable to describe African cultural complexes and will be used in this and the following chapter.

The early Middle Stone Age lithic industries of North Africa, such as those found at Jebel Irhoud, in Morocco (Fig. 4.1), are similar to those contemporary in Europe and the Near East, to the point that they were originally called Mousterian. The technological assemblage from Jebel Irhoud was taken to infer that it must have been produced by Neanderthals, as it happened in Europe, and consequently the Jebel Irhoud fossils were assigned to the Neanderthal species carelessly of the actual skeletal morphology (Ennouchi 1962). The assumption, based on European evidence, was that the presence of the Levallois technique had to be assigned to the Mousterian, which – in Europe and the Near East – was typically produced by Neanderthals. More accurate anatomical analysis later demonstrated that the Jebel Irhoud fossils do not share any common trait with

Neanderthal (Hublin 2001) and that their dental features are very similar to modern *Homo sapiens* (Smith *et al.* 2007). Therefore, the North African human fossils and archaeological records impose a “conceptual revolution” in the classic Middle Palaeolithic pattern of the Mediterranean basin: the Levallois technique existed in the period corresponding to the Middle Stone Age, but was produced by modern humans, not Neanderthals.

This chapter presents the cultures of the human populations who lived in North Africa between about 130 and 40 ka ago. This period features two main cultural horizons, an earlier one corresponding to the early Middle Stone Age, and a later one exhibiting a characteristic complex of North Africa, called Aterian.

North African climate and environment between 130 ka and 40 ka BP

In North Africa, the interglacial/glacial alternations appeared in different forms from those in Europe. As a matter of fact, there has never been an ice age in North Africa as latitudes and altitudes were too low to allow extremely cold temperatures. The highest mountains of the Maghreb were the only exception where an ice sheet developed during the period corresponding to the ice age in Europe. On the other hand, dramatic climate changes in Europe affected the environment in North Africa. When ice sheets reached southern Europe and the sea level of the Mediterranean withdrew, temperatures lowered in North Africa, as well, and precipitations were reduced on the African Mediterranean coast and disappeared inland. The climate became very dry and the Sahara desert encroached, often being even drier than today.

The moistest phase, equivalent to MIS 5e, occurred between 125 ka and 120 ka BP, corresponding to the beginning of the Last Interglacial. At this time, stable land surfaces and dense vegetation cover developed (Fig. 4.2),

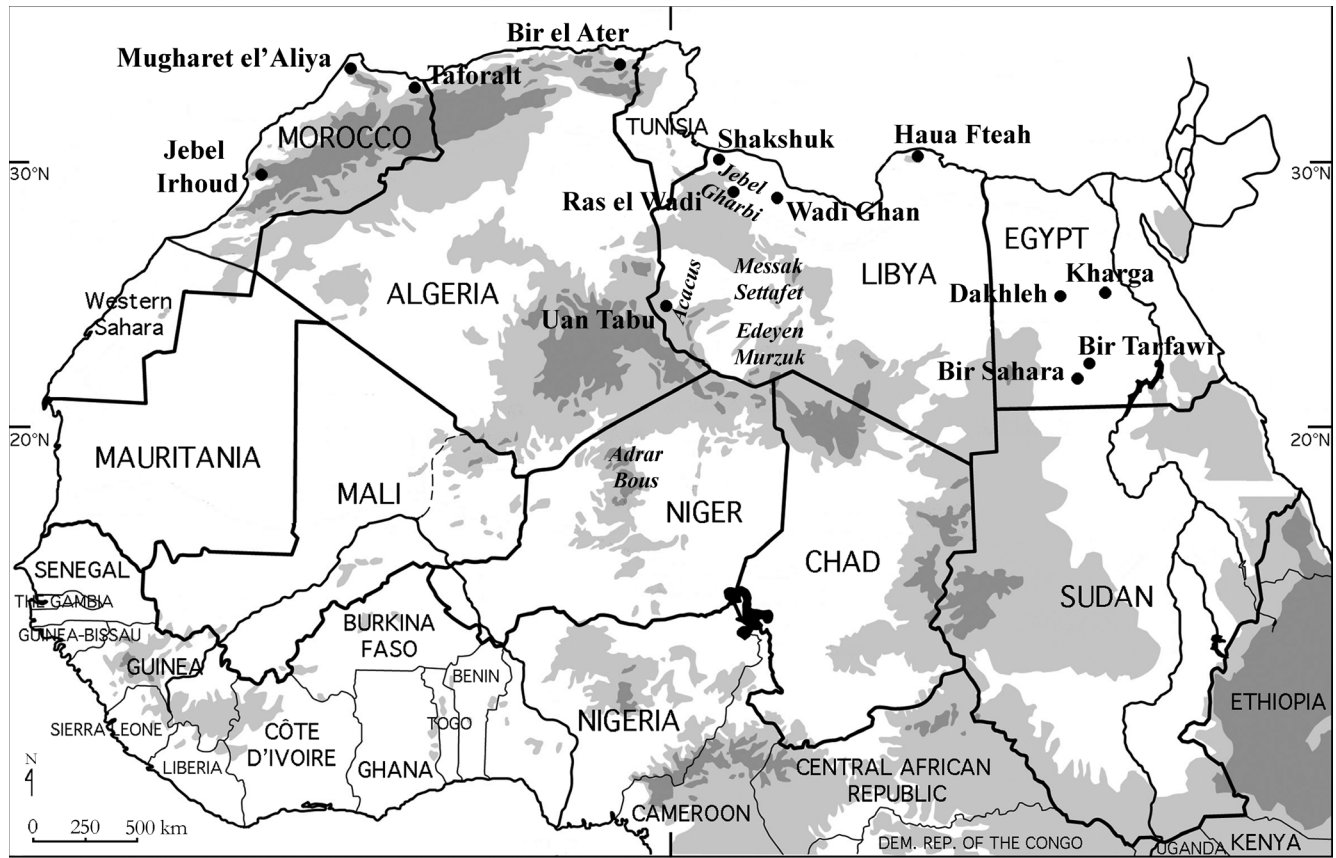


Figure 4.1. Map of sites cited in the text.

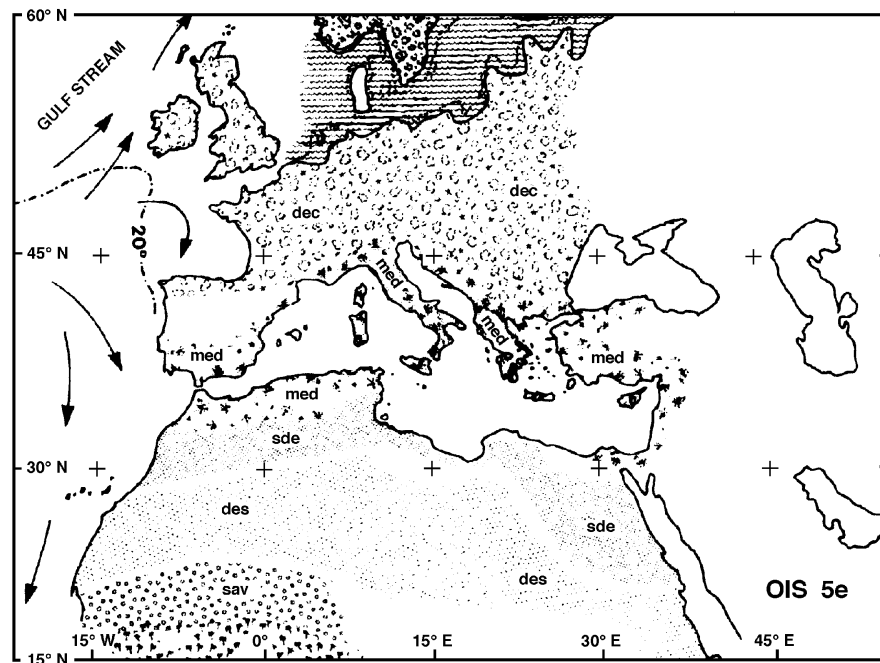


Figure 4.2. Map of the palaeoenvironments of the Mediterranean Basin at the Last Interglacial (MIS 5e), 125–120 ka BP: dec: deciduous forest; med: Mediterranean evergreen woodland; sde: semidesert; des: desert; sav: Sahelian savannah (adapted from Van Andel and Tzedakis 1996).

rainforest occupied a much greater area than at present and rainfall was generally higher. It has been suggested that the situation resembled that of the early Holocene, around 8000 BP (Adams 1998). Three different biogeographical zones characterised North Africa: the mountain ranges of the Maghreb with Mediterranean forest; the northern peridesert with savannah vegetation; and the desert proper in the Sahara with seasonal grassland vegetation.

The landscape changed and exhibited major river aggradations around 111–109 ka and 88 ka BP, suggesting cool temperatures and strong aridity, affecting the Inter-tropical Convergence Zone (ITCZ) (Macklin *et al.* 2002). The ITCZ is a belt that circles the earth, around the equator, where the north-east trade winds meet the south-east trade winds. When these winds come together, low pressure is formed and moist and warm air is forced upward. As the air rises, it cools, releasing the accumulated moisture in heavy precipitation. The location of this belt varies over time, and longer term changes can result in severe droughts or flooding in nearby areas. The ITCZ moves back and forth across the equator in a semiannual pattern, following the sun's zenith point. Its movements follow the area of most intense solar heating, or warmest surface temperatures. Variation in the location of the ITCZ still drastically affects rainfall in many equatorial countries, resulting in the wet and dry seasons of the tropics. During dry periods, the ITCZ moved farther north from the equator and, during the summer monsoon, could go as far north as beyond the central Saharan watershed and even affect flooding into the Mediterranean (Rohling *et al.* 2002). Mollusc shells indicated the existence of a fossil lake in southern Tunisia

that was dated by the U/Th method to around 100–90 ka BP (Causse *et al.* 2003). This humid event was recorded in other parts of North Africa, including the Sahara. Other shells were collected in southern Algeria and dated with the same method, confirming a humid episode at c. 102 ka BP and suggesting other short ones at 90 ka and 75 ka BP (Fontes and Gasse 1991). In central Libya, Lake Megafezzan was active during MIS 5 (Drake *et al.* 2008; Geyh and Thiedig 2008) and had a considerable extension (cf. Smith, Chapter 2). In the same area, various lacustrine sediments in present Lake Shati were dated from around 200 ka to 77 ka BP (Gaven *et al.* 1981) and confirmed the existence of lakes in the Sahara during this period.

No humid episode occurred in North Africa after 65 ka BP (Wendorf and Schild 1992; Wendorf *et al.* 1993). Dry cold spells favoured the expansion of the Sahara desert to the north and aeolian sand beds deposited between 70 ka and 58 ka BP in presently peridesertic north-western Libya (Giraudi 2005). The sea level on the African coast was about 75 metres below the present one and the vegetation was as reduced as at the Last Glacial Maximum (Fig. 4.3) (Adams 1998). In the Maghreb, the Soltanian, which is the local stage corresponding to the Würm in southern Europe, featured a succession of dry phases with cool winters alternated with shorter and more humid spells. Trees and shrubs included conifers, such as thuja, Aleppo pine and juniper. Among the fauna, white rhinoceros, zebras, wild horse, wild ass and aurochs were significant (Wengler *et al.* 1992).

The early Middle Stone Age can be mainly associated with the Last Interglacial of MIS 5 that spanned between

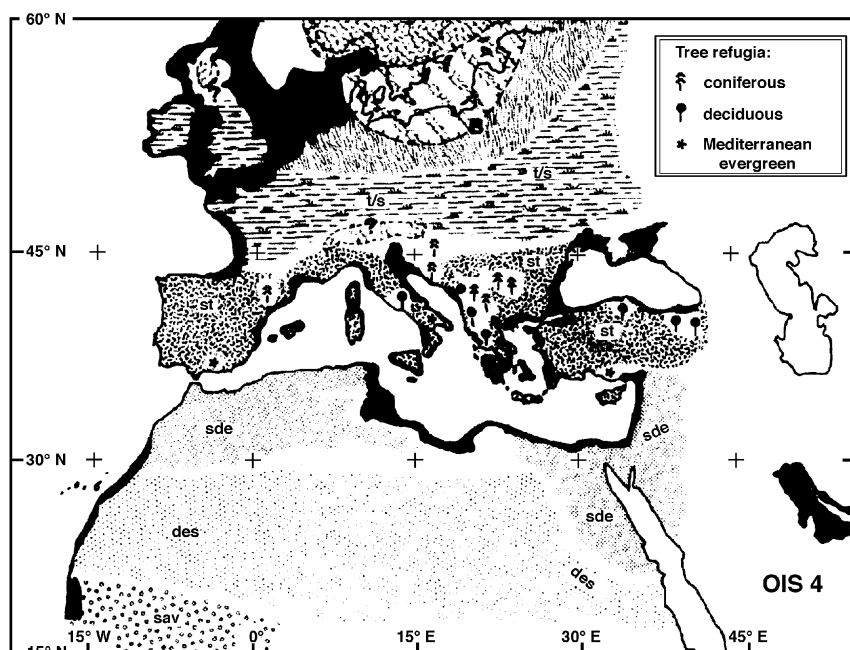


Figure 4.3. Map of the palaeoenvironments of the Mediterranean Basin in the late MIS 4 at 65 ka BP: t/s: tundra and cold steppe mosaic; st: arid cold steppe; sde: semidesert; des: desert; sav: savannah (adapted from Van Andel and Tzedakis 1996).

about 125 ka and 80 ka ago, although it started earlier, during MIS 6, and may have ended earlier than 80 ka BP, at least in some locations. On the other hand, the Aterian was found in sandy sediments formed under dry conditions (Cremaschi and Trombino 1999, 2001), suggesting that it developed during the Last Glacial of MIS 4. This evidence confirms successful adaptations by Aterian peoples to desert environments in different parts of the central and southern Sahara, and even in the Maghreb, where the climate was semi-arid to arid (Clark 1980; Garcea 2010). It is likely that the population in the Maghreb and coastal Africa grew when the occupation in the Sahara came to an end due to constantly increasing aridity, around 60 ka BP (Clark 1980, 1993). Research in the Tadrart Acacus mountain range of the central Sahara, south-western Libya, and in the Jebel Gharbi, north-western Libya, has shown that the Aterian disappeared from the Sahara around 60 ka BP, whereas it continued in the north during the first part of MIS 3, thanks to better climatic conditions (Garcea 2004, 2006).

Industries and chronologies

The early Middle Stone Age

Early Middle Stone Age tools, often made with the Levallois technique, are present almost everywhere in North Africa (Fig. 4.4). However, they more often occur in surface scatters than in stratigraphic position. Early Middle Stone Age people preferred to settle in open-air sites even where there were suitable rockshelters, such as in the central Sahara (Garcea 2001). In coastal Africa, as well, their sites can be difficult to identify as they are often deflated and artefacts are out of place. The only exceptions are a few caves that were used as sites and displayed a well-preserved stratigraphy.

Among cave sites, the Haua Fteah is located in Cyrenaica, east of Tripoli, at the foot of the Jebel Akhdar (Fig. 4.1). It was first excavated by McBurney (1967) and his team in the 1950s and provided one of the most complete Upper Pleistocene and Holocene archaeological sequences.

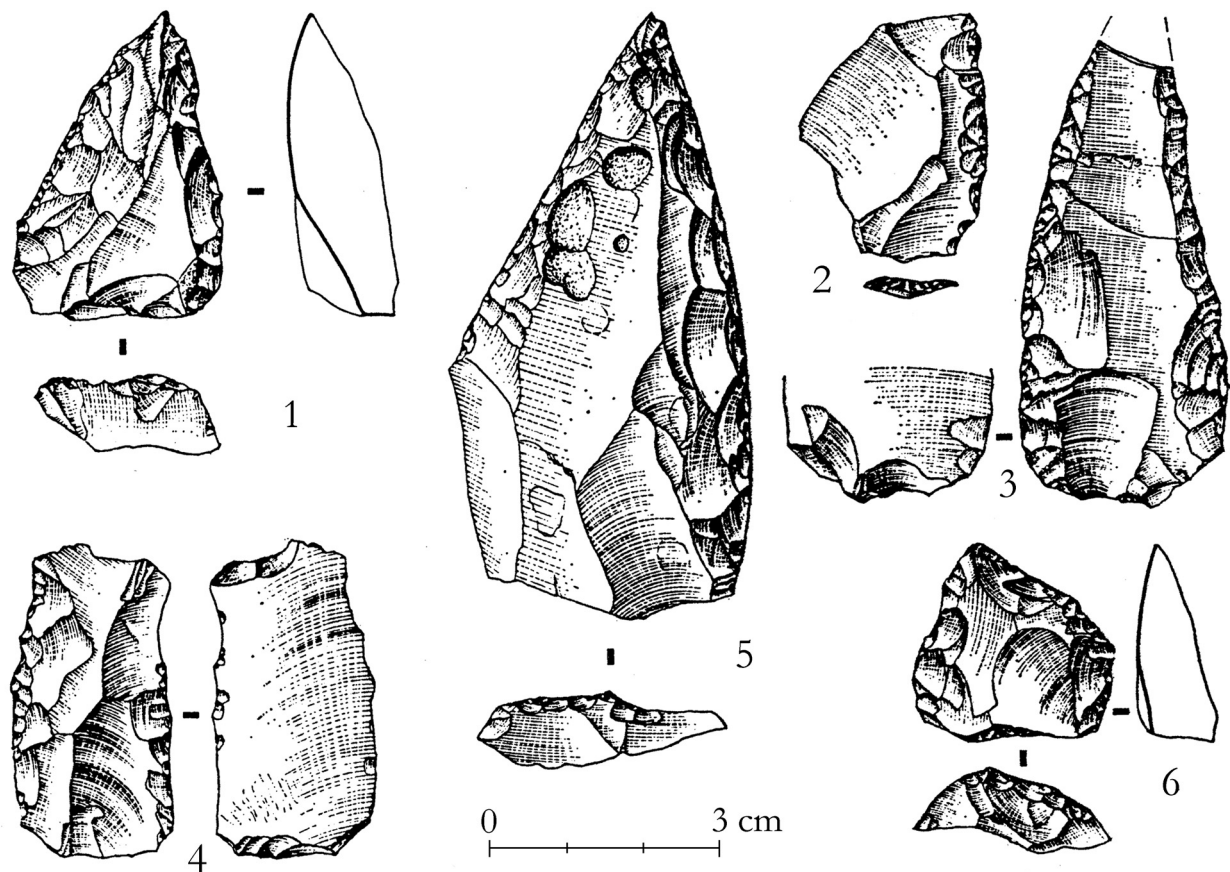


Figure 4.4. Early Middle Stone Age retouched tools from Oued Akarit (Tunisia): 1. Point; 2. Simple convex sidescraper; 3. Elongated point; 4. Double straight-convex sidescraper on a Levallois flake; 5. Point on a Levallois flake; 6. Dèjeté sidescraper (adapted from Tixier 1967).

Beginning from the bottom, the early Middle Stone Age was found in the lowest layers, XXXV and XXXIV (Fig. 4.5). The artefacts were scattered around hearths and included more numerous endscrapers, burins and burin spalls, in comparison with sidescrapers, bifacial tools and Levallois points (Fig. 4.6). This lithic assemblage suggested

a developed stage in the early Middle Stone Age, due to the greater relevance of endscrapers over sidescrapers. According to the associated animal remains, layers XXXV and XXXIV were attributed to the Last Interglacial, whereas the upper layers, XXXIII and XXXII, were assigned to the Early Würm (McBurney 1967). However, more recent chronology

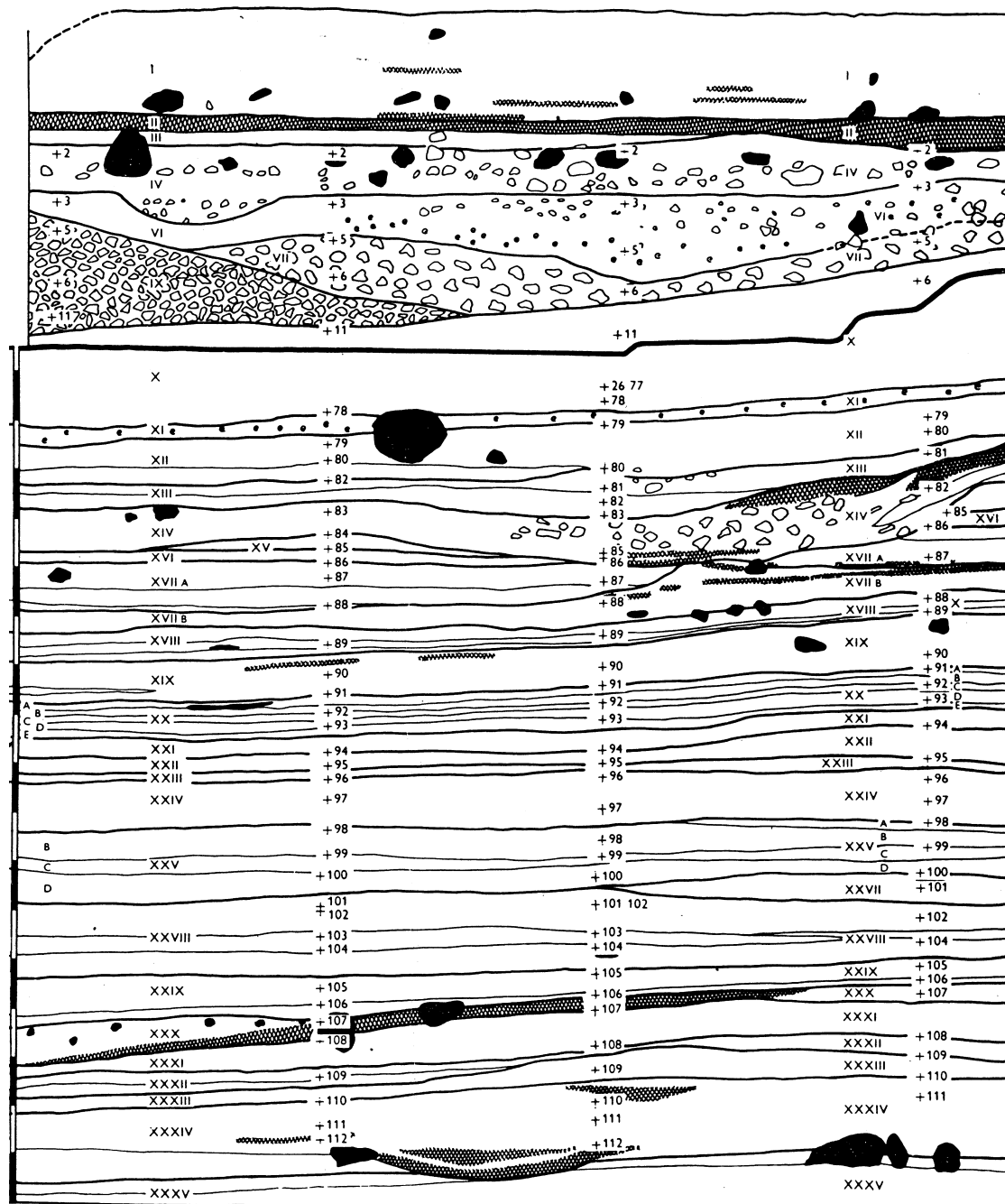


Figure 4.5. Stratigraphic section of the southern side of the 1955 excavation at the Haua Fteah cave (Libya) (adapted from McBurney 1967).

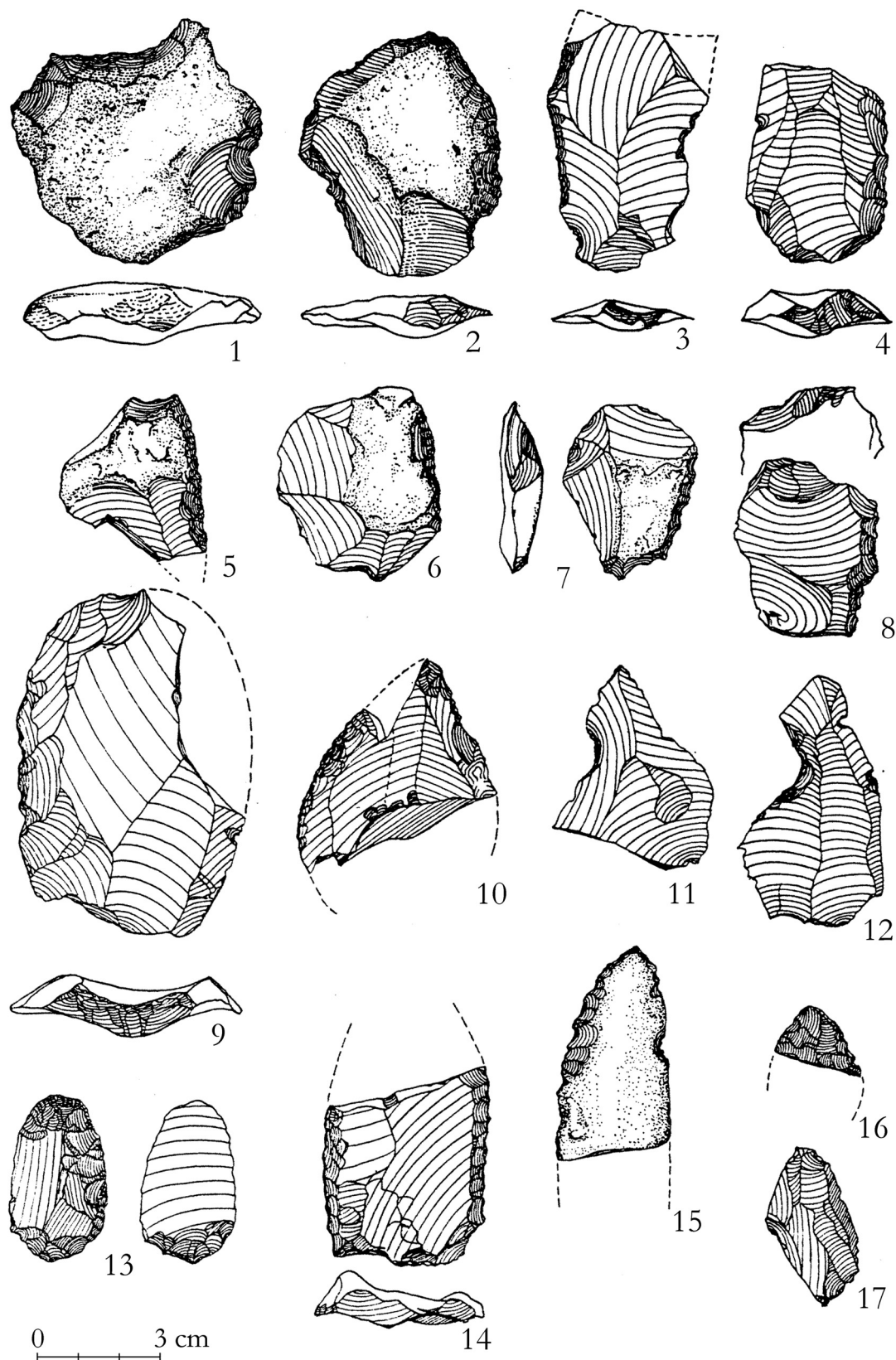


Figure 4.6. Early Middle Stone Age retouched tools from Haua Fteah (Libya): 1, 11, 12. Notched flakes; 2–9. Simple side scrapers; 10, 14–17. Points; 13. Double endscraper (adapted from McBurney 1967).

would suggest an earlier date still within the Last Interglacial for these layers, as the Early Würm, or Soltanian, is associated with the Aterian. Furthermore, their lithic assemblage featured a reverse proportion with respect to the lower layers (XXXV and XXXIV) with a prevalence of sidescrapers over endscrapers and burins, corroborating an attribution to the early Middle Stone Age. Moving upward in the stratigraphy (Fig. 4.5), layers XXXI and XXX contain a different assemblage from the layers below and suggest affinities with the Aterian, particularly for the presence of tanged pieces. As these layers exhibited a considerably lower quantity of artefacts, they have suggested that they may result from a single occupation or short-term visits. On top of the Aterian layers, the excavators seem to have found another late “Mousterian” occupation in layers from XXIX through parts of XXV. The attribution to the late “Mousterian” is due to the prevalence of points and absence of tanged tools, and has been interpreted as the result of a return of some “Mousterian” communities to the Libyan coast (McBurney 1967). Nevertheless, the absence of a tool type (*i.e.*, tanged pieces) can not be taken as the evidence for the presence of a different cultural complex. Other assemblages with no tanged tools have been found elsewhere, but still attributed to the Aterian, on the basis of indicators that are now recognised as more diagnostic than tangs (see below). Furthermore, this presumed interstratification of the Aterian between two seemingly generalised early Middle Stone Age episodes should be viewed with some scepticism. New investigations have been resumed in 2007 (Barker *et al.* 2007, 2008, 2009) and will hopefully clarify the stratigraphic and technological sequence of the Haua Fteah.

In general, local raw materials, that rarely travelled more than 10–30 km, were used to make early Middle Stone Age lithic techno-complexes (Wengler 1990; Clark *et al.* 2008). In eastern Morocco, several types of rocks were used in both the early Middle Stone Age and the Aterian, but in different proportions: during the early Middle Stone Age, coarse-grained rocks were more often exploited (Wengler 1990). Blades and elongated flakes were rarely used as blanks; faceted butts decreased with the decrease of the Levallois technique; slanted butts forming an obtuse angle were also more common in the early Middle Stone Age. Finally, sidescrapers and denticulates decreased in the Aterian in favour of types typical of the European Upper Palaeolithic, such as endscrapers, burins, perforators, backed knives and truncated flakes (Wengler 1997).

The Aterian

The Aterian derives its name from the type-site of Bir el Ater, located in the wadi Djebbana, eastern Algeria (Fig. 4.1). It was discovered around 1917 by Reygasse (1921–22), who recognised a “developed Mousterian” techno-complex with basally-thinned pieces. The eponym, Aterian, had a much better fortune than the original site and its lithic

collection. Erosion destroyed Bir el Ater and its collection was dispersed in several museums and various private collections (Morel 1974). The only available data on this site is now a synthesis of Morel’s recollections of the observations and sondages he made between 1944 and 1962 (Morel 1974). Therefore, Aterian soon became a *nomen nudum*, a meaningless name (Antoine 1938). In the absence of a precise term of reference, several scholars provided their own definition of Aterian, often on the basis of their experience in other geographic contexts. Nevertheless, since the Bir el Ater discovery, hundreds of similar assemblages have been found in North Africa. Both Africanist specialists (*e.g.*, Tixier 1958–59; McBurney 1967) and European archaeologists (*e.g.*, Bordes 1961) originally regarded tanged tools as the distinctive “guide fossil” of the Aterian. However, the presence of tanged tools as the evidence for the Aterian was questioned by J. D. Clark (1982) and later discussed by M. Kleindienst (1998), who considered bulbar basal thinning and bifacial retouching as much more distinctive features. In fact, tanged tools are not necessarily always present in Aterian assemblages, especially with regards to surface collections or limited test trenches, which were the most common research method in Africa.

The Aterian was first discovered in the Maghreb and surroundings, whereas it was almost unknown in the central Sahara. It seemed that Aterian groups only occasionally visited the Saharan mountain ranges for hunting or raw material procurement purposes (among others, Tillet 1987, 1995; Debénath 1994). Excavations at the Uan Tabu rockshelter, in the Tadrart Acacus mountain range, southwestern Libya (Fig. 4.1), brought to light a stratified site with a large Aterian techno-complex (Fig. 4.7) in a stratigraphic sequence below an early Holocene deposit (Garcea 2001). The lowest unit (Unit IV) of the sequence comprised five layers (21–25) with a maximum thickness of 100 cm (Fig. 4.8). It was separated from the upper three units by an unconform erosional surface, indicating that a considerable lapse of time, probably around 50 ka, passed between the two formations. The deposit with Aterian artefacts included sandstone blocks that collapsed from the vault of the shelter, due to a dramatic decrease in both temperature and humidity, which took place in the late Upper Pleistocene. Two stratigraphically different assemblages could be distinguished: the upper layers, 21 and 22, showed quite distinct features from the lower layers, 24 and 25. Layer 23 appeared to be an intermediate layer and it included the lowest amounts of lithic artefacts. The upper layers comprised a few lithics made on raw materials different than sandstone, which was the exclusive rock employed in the lower layers. Levallois flake cores were more frequent in the upper layers. Levallois point cores were only present in the upper layers. On the contrary, Nubian cores (Fig. 4.7, 2) were exclusively recorded in the lower layers. The Nubian technique is called so because it was first recognised in

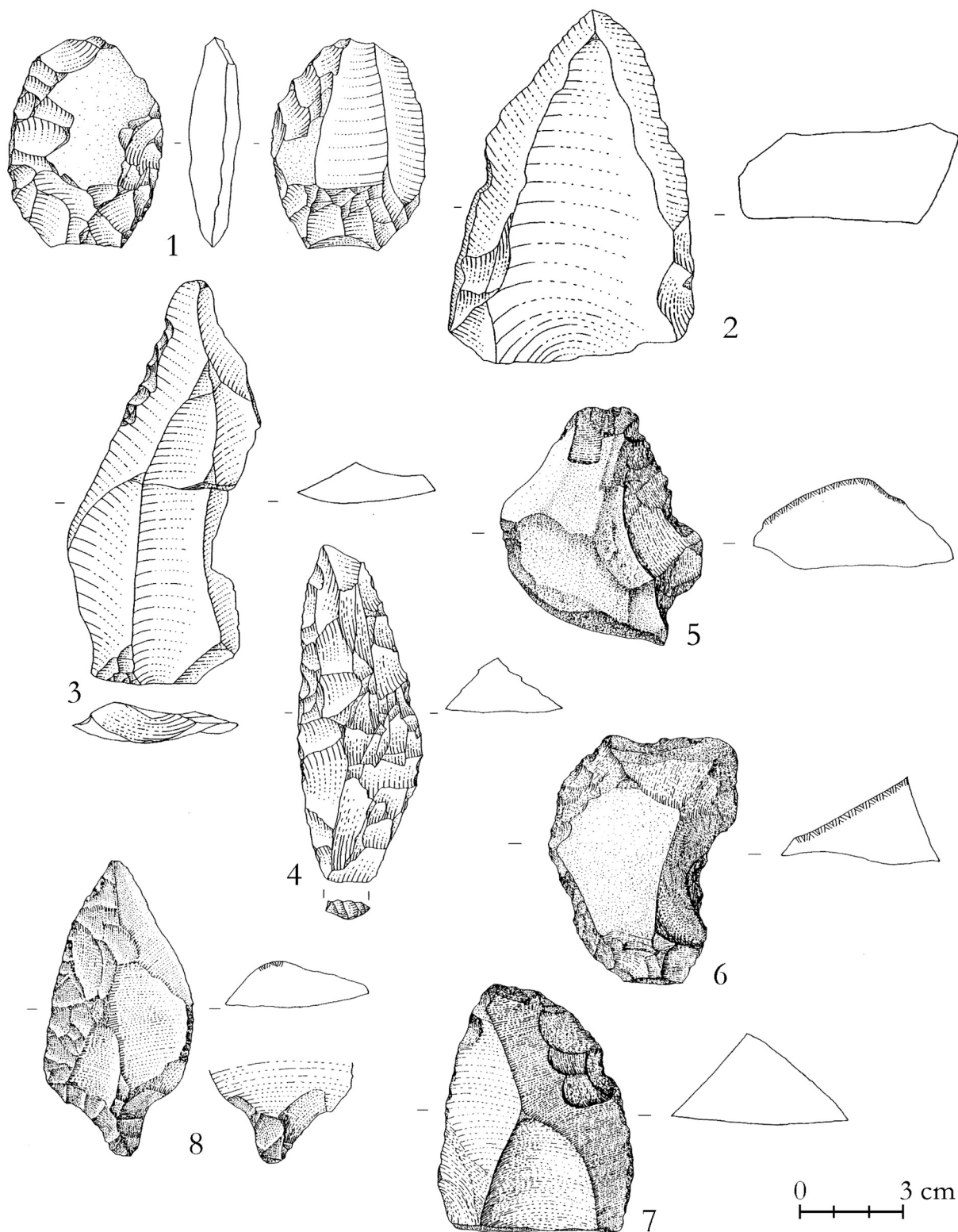


Figure 4.7. Aterian retouched tools from Uan Tabu (Libya): 1. Levallois flake core; 2. Nubian core; 3. Retouched Nubian point; 4. Elongated point; 5. Simple concave sidescraper; 6. Double concave-convex sidescraper; 7. Convergent-convex sidescraper; 8. Tanged ogival point.

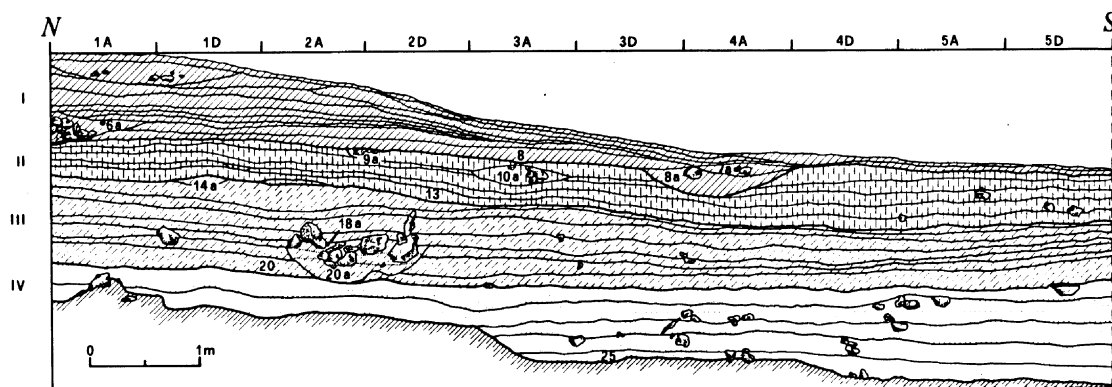


Figure 4.8. Stratigraphic section of the excavation at Uan Tabu (Libya).

Nubia (cf. Chapter 6). It is a variation of the Levallois technique, but follows a bipolar system of core preparation. Two types of Nubian technique were distinguished: Type 1, which is used to make points or pointed flakes after bipolar preparation of the core, that is, by working the core only from the proximal and distal ends; and Type 2, which implies the preparation of a triangular core with a central ridge, obtained by transversal scars on both the dorsal and ventral sides, and a careful trimming of the proximal end (Guichard and Guichard 1965, 1968; Van Peer 1991). West of Nubia, the Nubian technique is not very common, usually exhibiting the Type 1, as is the case in the Libyan Sahara. At Uan Tabu, Levallois flakes and Levallois blades were more frequent in the upper layers. Furthermore, single platformed cores, especially the unpatterned type, were more common in the upper layers. As for the tool-kit, sidescrapers were more common in the upper layers. Furthermore, endscrapers, burins, truncated flakes, and *hachoirs* were only represented in layer 21 (Fig. 4.7). Perforators also occurred in the upper layers. On the other hand, the lower layers included natural backed knives, tanged points and tools, and *hachereaux*. Notches and denticulates were the predominant tool category and were equally distributed in the two horizons.

Other Aterian sites were found in the Tadrart Acacus, as well as the Messak Settafet and the Edeyen of Murzuq (Fig. 4.1), in the Libyan Sahara (Garcea 1996; Cremaschi and di Lernia 1998; Van Peer 2001), and other Saharan mountain ranges (Garcea 2001; Clark *et al.* 2008), confirming that the Aterian was widely spread throughout the Sahara. The large number of Aterian sites in the Sahara allows to reconsider the location for the origin of the Aterian, which was earlier indicated in north-western Africa. However, the Aterian now appears to be older, or as old, in the Sahara and shows links with sub-Saharan Africa (Kleindienst 1998). Furthermore, on technological grounds, the Aterian from the Sahara was compared to the early Aterian or “Moroccan facies”, and

not to the “Djebbana facies”, identified at Bir el Ater, which was attributed to the upper Aterian (Clark 1980).

Moving back to coastal Africa, research has been conducted in the Jebel Gharbi massif (also known as Jebel Nafusah) and at the foot of the northern scarp. The Jebel Gharbi is located in the northern part of the Tripolitanian plateau, 60 km from the Mediterranean coast at Gharyan, to the east, and 135 km at Nalut, to the west (Fig. 4.1). The mountain range is known since the 1940s, thanks to the geo-archaeological investigations by McBurney and Hey (1955), who concentrated their fieldwork in the Wadi Ghan, near Gharyan. Here, recent investigations confirmed that the stratigraphic series comprises a unit with early Middle Stone Age artefacts below another unit including Aterian artefacts (Figs. 4.9 and 4.10). During the Upper Pleistocene, tectonic faults in different location of the massif and its foot produced a number of earthquakes of high magnitude that opened outlets of underground aquifers flowing through the fissures created by the tectonic faults. One of the most interesting examples is Ras el Wadi in the Wadi Ain Zargha, where a still active aquifer (Fig. 4.11) feeds the outlet of the water spring, assuring water resources even during dry times. Human settlements concentrated upstream of the spring and the variety of flints used for lithic industries suggested that various groups from different parts of the jebel visited and settled in the area. Moving toward the foot of the jebel, a series of springs in the Shakshuk area shows that the fault system has guaranteed the outlet of underground water even in arid periods. Aterian sites are numerous and well-documented in this area. They exhibit two stratigraphically different horizons that precede the Later Stone Age, including typical Aterian and later, still Aterian, complexes (Fig. 4.12).

Even though some general Aterian techniques and tool-kits appeared over a large territory, they did not occur everywhere at the same time, but were separated by tens of

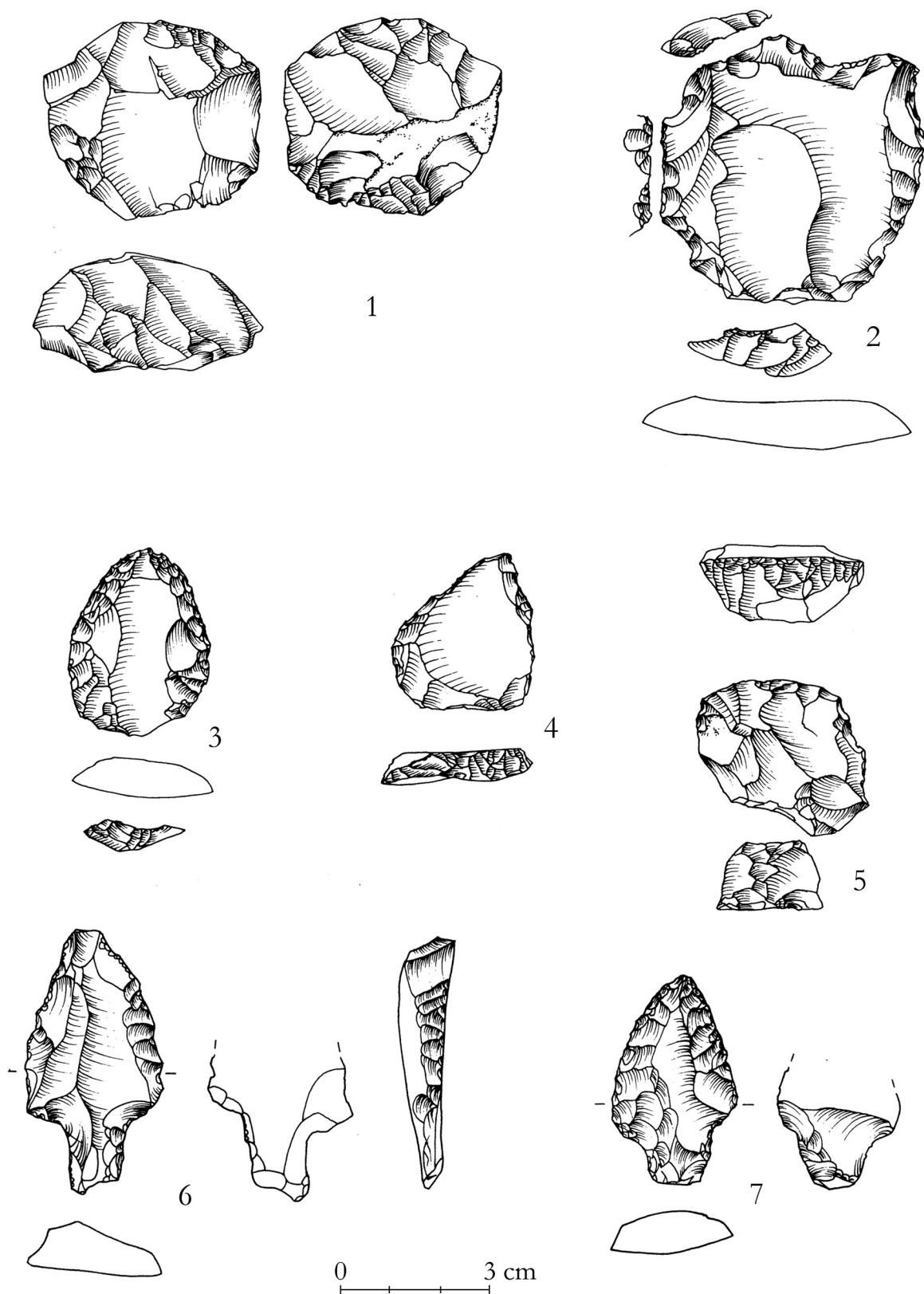


Figure 4.9. Aterian retouched tools from the Jebel Gharbi (Libya): 1. Levallois core; 2. Denticulated flake; 3. Convergent-convex sidescraper; 4. Perforator; 5. Simple endscraper; 6–7. Tanged points. 1–5 from Wadi Ghan, 6–7 from Ain Zargha (Ras el Wadi).

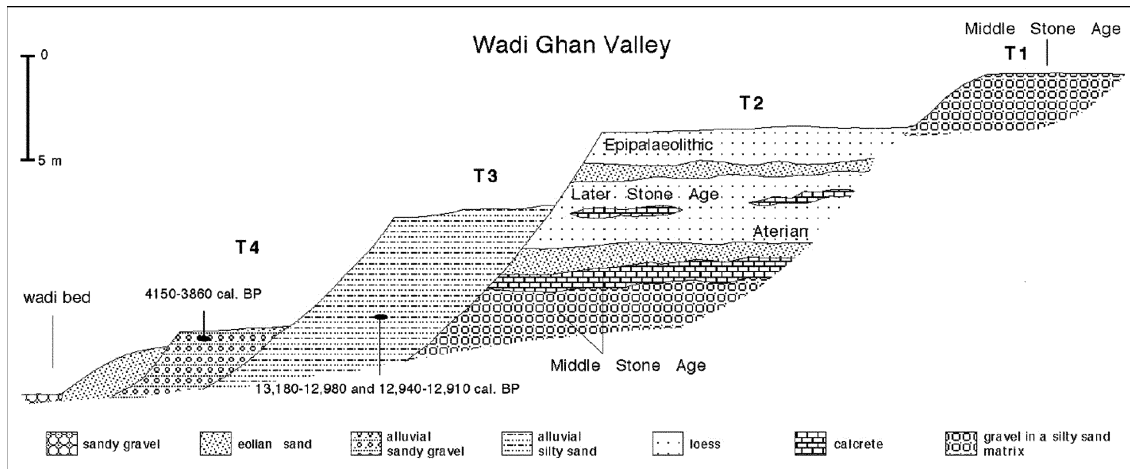


Figure 4.10. Stratigraphy of the Wadi Ghan (Libya) (adapted from Garcea and Giraudi 2006).



Figure 4.11. The Ras el Wadi spring.

millennia. In fact, different Aterian horizons in Libya represent various cultural groups with chronological, technological and typological diversities (Garcea 1998). It is likely that, during the late Aterian, groups were fewer and more inclined to isolation and conservative organization due to increased dry conditions that caused a population

crash during the middle part of the Last Glaciation. Such a system could explain the conservative duration of technical traditions from the early Middle Stone Age to the late Aterian and could justify their spread over such a vast territory (Garcea 2004).

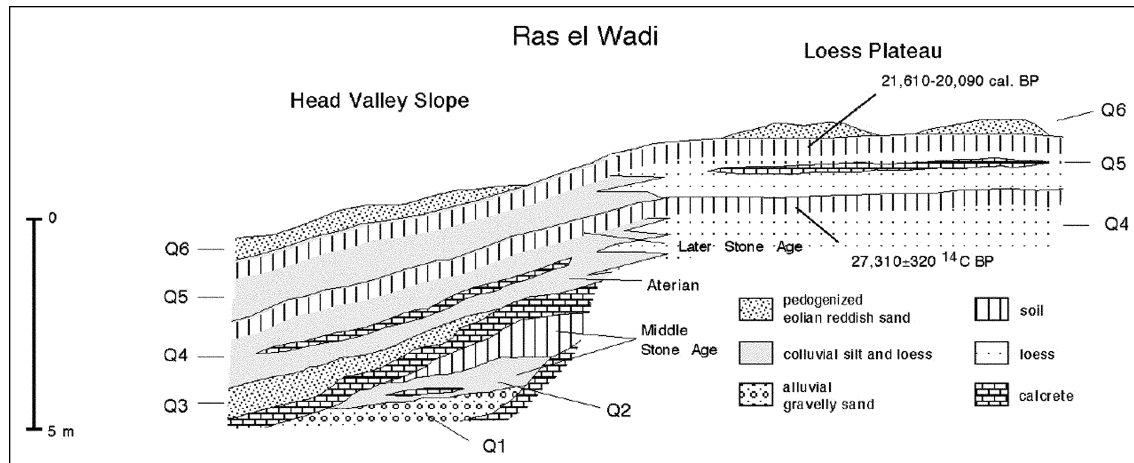


Figure 4.12. Stratigraphy of the Ras el Wadi in the Wadi Ain Zargha (Libya) (adapted from Garcea and Giraudi 2006).

The chronology of the early Middle Stone Age

The age for the beginning of the Middle Stone Age is still unsure, but can be placed at MIS 6. Jebel Irhoud was first radiocarbon dated to $\geq 32,000$ years BP (Camps *et al.* 1968), but electron spin resonance (ESR) determinations on tooth enamel samples found near the human remains provided more accurate dates: estimates ranged between 125 ka and 90 ka BP and between 190 ka and 105 ka BP (Grün and Stringer 1991).

A possible association with the White Lake phase in the Bir Sahara/Bir Tarfawi area has been suggested for an early Middle Stone Age assemblage identified in the Wadi Adroh, in the Messak Settafet, Libyan Sahara (Van Peer 2001). In the Western Desert of Egypt, the White Lake phase is dated about 160 ka BP (Wendorf *et al.* 1993). Furthermore, the so-called Upper Levalloisian, which is a facies of the early Middle Stone Age at Dakhleh Oasis, further north in the Egyptian Western Desert, pre-dates Caton-Thompson's (1952) Kharga Aterian and has now been dated by uranium-series determinations on tufa deposits to $125,000 \pm 1,600$ years BP (Churcher *et al.* 1999).

To-date, there is still a debate on whether there was a chronological gap, or a direct succession of the early Middle Stone Age and the Aterian. In Morocco, there seems to be a direct succession and a stratigraphic continuity (Wengler 1997), whereas in other areas, such as the Wadi Ghan in the Jebel Gharbi, north-western Libya, a chronological gap separates the two cultural horizons. In fact, in the Wadi Ghan, there are lava flows with rolled early Middle Stone Age materials below a deposit with Aterian industries, indicating that a chronological hiatus separated the two cultural complexes, when the lava accumulated between the early Middle Stone Age and the Aterian occupations. Thus, it is possible that early Middle Stone Age people did not last

everywhere until the time of the Aterian transition. It seems also likely that the former were fewer than the latter, considering the higher number of Aterian sites in North Africa. The people who survived through MIS 4 certainly had to switch to more modern techniques of food acquisition and preparation, some of which required an adaptation of local traditions, while others came from other parts of Africa, eastern Africa being the most probable candidate (Clark 1993; Kleindienst 1998; Clark *et al.* 2008; Garcea 2010).

The chronology of the Aterian

Until recently, almost all absolute chronologies for the Aterian were determined with the conventional radiocarbon method, which is a very reliable method, but only for ages younger than 40–50 ka. When ages are older, radiocarbon measurements can only provide infinite dating, “greater than” a certain age. For example, finite dates of the Aterian levels at Taforalt were $19,080 \pm 250/19,400 \pm 250$ years BP and $21,860 \pm 330$ BP, whereas the infinite one was $\geq 40,000$ BP (Delibrias *et al.* 1982). As the finite dates seemed more precise, they were retained, whereas the infinite one was rejected. In addition to technical limitations of the dating method, there have been conceptual preconceptions in dating the Aterian, as it was originally thought to be associated with a humid episode which was presumably dated to 40–20 ka ago. This assumption can now be rejected for several reasons mentioned above that can be summarised here. First of all, none of the Pleistocene lacustrine events in the Sahara is dated to that period; secondly, no humid episode occurred after 65 ka BP; and thirdly, Aterian artefacts lay in sandy sediments accumulated under dry conditions. Therefore, in order to obtain more reliable dates than infinite ones, other dating methods have been used and compared with the radiocarbon.

Dates made with other methods than conventional radiocarbon confirmed that the infinite radiocarbon measures were more correct than finite ones, as the age of the Aterian often goes beyond the range of standard radiocarbon dating. Uan Tabu, in the Tadrart Acacus mountain range, south-western Libya, is one of the first Aterian sites which gave an age that required a revision of the entire chronological framework of the Aterian. Excavations at this site brought to light a 100-cm thick deposit with Aterian artefacts. Its upper layer was dated by the optically stimulated luminescence (OSL) method to $61,000 \pm 10,000$ BP (Martini *et al.* 1998; Garcea 2001). This age for the Aterian was confirmed by the thermoluminescence (TL) method, that gave ages of $70,500 \pm 9500$ and $73,000 \pm 10,000$ years BP, and by the OSL method that gave $69,000 \pm 7000$ BP, for the rockshelter of Uan Afuda, in the same mountain range (Cremaschi *et al.* 1998; Martini *et al.* 1998).

Other techniques, such as U/Th, were used to date calcareous crusts on top and below silts containing Aterian artefacts from the Jebel Gharbi, north-western Libya, and gave ages <85 ka BP and >43 ka BP, thus providing a time span for the chronological extent of the Aterian in this area. It should also be noted that the radiocarbon dating method has considerably improved since the 1950s–1980s, when the first radiocarbon dates were obtained for the Aterian. In fact, radiocarbon dates confirmed the youngest ages in the Jebel Gharbi, giving $43,530 \pm 2110$ years BP at Shakshuk and $44,600 \pm 2430$ BP at Wadi Sel, near Shakshuk (Barich *et al.* 2003a, 2003b, 2006; Garcea 2004; Giraudi 2005; Garcea and Giraudi 2006). Furthermore, Electron Spin Resonance (ESR) provided dates on tooth enamel from Mugharet el ‘Aliya, Morocco, and again confirmed the existence of Aterian occupations in Morocco before 40 ka BP. The teeth from the uppermost level yielded ages ranging from $39,000 \pm 4,000$ to $44,000 \pm 5,000$ years BP and from $56,000 \pm 5,000$ to $47,000 \pm 5,000$ years BP, whereas the teeth from the lowest level provided ages of $81,000 \pm 9,000$ and $62,000 \pm 6,000$ BP. Furthermore, the type of animal remains found at this site corroborated a pre-40,000-year chronology as they consisted of species that could not survive in a very dry environment (Wrinn and Rink 2003). Ultimately, in the Adrar Bous, southern Sahara, Niger, the geological sequence associated with the Aterian was approximately dated between ≤ 150 ka and ≥ 40 ka BP (Williams 2008).

To sum up, we can say that since the late 1990s there is general agreement that the Aterian spans the period between c. 40 and, at least, 80 ka or most likely earlier (Wendorf and Schild 1992; Kleindienst 1998, 2000; Garcea 2001, 2009; Wrinn and Rink 2003; Wengler *et al.* 2006; Bouzouggar *et al.* 2007; Mercier *et al.* 2007; Roset and Harbi-Riahi 2007; see also Schwenninger *et al.*, Chapter 3).

Modern humans with modern behaviour

It has been hypothesised that the Strait of Gibraltar could have been easily crossed by Aterian groups as it was even narrower than today when the sea level lowered during the glacial period. However, several aspects have been considered, combining the chronological, technological, anthropological, organisational and environmental evidence, none of which is able to support the hypothesis that early modern Africans chose the Strait of Gibraltar as one of their routes out of Africa (Garcea 2004). Aterians developed a specific African adaptation to African environments and took advantage of the Mediterranean environment and climate, which played a critical role in the survival of Aterian populations towards the end of MIS 4, when the landscape became too harsh in many parts of inland North Africa.

Aterian populations were fully modern humans, who kept some traditional techniques inherited from their predecessors producing early Middle Stone Age industries. From a technological point of view, Aterian techno-complexes were similar to those that Neanderthals made in Eurasia. Therefore, the Levallois technique, as well as the production of generalised tools, such as sidescrapers or denticulates, can not be taken as behavioural indicators as they can be associated with either Neanderthal or modern humans. On the other hand, Aterians adopted a wide range of modern behaviours that were unknown to Middle Palaeolithic populations in Eurasia (Garcea 2009).

Aterians developed a desert-oriented adaptation and resisted in the Sahara until it became a hyper-arid desert (Clark 1980, 1993; Garcea 2010). Even in the Maghreb the climate was semi-arid (Wengler 2001), although it was still able to sustain the populations who must have left the Sahara, when conditions became hyper-arid in the south. This skill to adapt to harsh environments and climatic conditions has been seen as one of the typical indicators of modern behaviour.

Another evidence for Aterian modern behaviour comes from the variety of exploited natural resource. Various lithic raw materials became in use and fine grained rocks were preferred for a more accurate manufacture of some tools (Wengler 1990, 1997). At Uan Tabu, sandstone was the only exploited rock until the later occupation attested to the upper layers (21 and 22). Raw materials included quartzite that was available in the Messak Settafet, located some 80 km east/north-east of the Tadrart Acacus. In order to have access to that rock, human groups must have left the Tadrart Acacus mountain range and crossed the lowland of the Erg Uan Kasa, before reaching the Messak Settafet. This high degree of regional mobility was especially adopted by later Saharan Aterian groups and must have sustained the population dispersal from the Sahara at the onset of severe climatic conditions.

The composition of tool-kits exhibited a wide range of lithic types indicating the practice of more diversified subsistence activities for the acquisition of food supplies, than in the early Middle Stone Age. Within tool-kits, the production of tangs was a total innovation. Tangs were not only used for mounting or hafting stone tools on supports made of other materials, such as wood, but could also be the active part of the tools, as use-wear analysis has now shown (Massussi and Lemorini 2004–05; Garcea 2010). Moreover, a variety of bone tools appeared (El Hajraoui 1994), suggesting the need to expand the range of raw materials used to make tool-kits with other materials than stone.

Fishing and fowling considerably increased during the Aterian, as indicated by the position of several sites near water resources and by the composition of the faunal assemblages (Wengler 2001). However, several Aterian sites in the Sahara were located near ephemeral water resources, suggesting that Aterian groups had a flexible and opportunistic adaptation which favoured their expansion over a wide area under varying environmental conditions (Marks 1975). The search for water sources must have been particularly important in a period of general aridity, as also indicated in the settlement system of the Jebel Gharbi, in north-western Libya.

Habitation structures including slabs, wedging elements, post holes, and fences were found at different sites in Morocco (Debénath 1992). On one hand, this suggests less temporary settlements and an increased consideration for residential spaces, on the other, it confirms that Aterian populations tended to practise regional, and not large-scale, mobility. Structured hearths appeared, particularly in Morocco (Debénath 1992). Food consumption must then have required a longer preparation at the advantage of a better assimilation of food values.

The growing number of Aterian sites found in North Africa gives priority, for the time being, to the need to focus on the different aspects of the Aterian, which do not seem to be equivalent everywhere. The various Aterian facies, with different chronological spans, are usually based on the typological differences of the tool-kits. However, other local and interregional variables should be considered in order to determine whether there were chronological, geographical, or functional diversities among the various “Aterians” (Garcea 1998). Aterian populations, although scattered and isolated, spread throughout the Sahara and North Africa, succeeding in the challenges to survive in dry environments.

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The Lower and Upper Later Stone Age of North Africa

Elena A. A. Garcea

Cultural transition without biological replacement

The North African Later Stone Age (LSA), its transition from the Middle Stone Age, its development and end are very peculiar and do not display substantial affinities with other contemporary cultures in the Mediterranean or the Nile Valley. Therefore, if using European-based terms to define African prehistory is generally questionable, it is more so with regards to the period that chronologically corresponds to the Upper Palaeolithic in Europe and in the Near East. Several scholars still hesitate to apply them to North Africa for different reasons. Their European background is certainly one reason, probably the main one. A paucity of available data particularly on this period, which needs to be better defined, is certainly another reason. A third one is that, due to scanty information, there is uncertainty on the pathways that modern African humans followed after they left East Africa and before they reached the Levant and Europe, and whether they ever returned to North Africa from the Levant (cf. Garcea, Chapter 11). At any rate, whichever term we use to describe the late Pleistocene North African cultures, and whichever role other cultures around the Mediterranean basin had on their southern neighbours, the Mediterranean climate and environment enormously affected the existence and development of North African populations.

Chapter Four explained that Aterian people in the Sahara dispersed around its margins *c.* 60 ka BP at the onset of unsustainable climatic conditions (Garcea 2001). Some groups were likely to have moved into the Maghreb and coastal Africa, where their culture survived until about 40 ka BP. However, beginning from that time, archaeological sites seem to be drastically reduced in many parts of North Africa. What happened to the Aterians? From an anatomical point of view, they were fully modern and therefore they had the cognitive skills to shift to more efficient technologies. Neanderthals were replaced by modern humans

in Europe and south-western Asia, but this was not the case in North Africa. If Aterians undertook a cultural transition without having to deal with a competing species, why so few people lived in coastal Africa in the late Upper Pleistocene, where the climate was certainly not optimal, but definitely better than in Europe, where Upper Palaeolithic cultures rapidly flourished everywhere? What was “wrong” with North Africa, which until then had been able to offer a supportive environment to modern humans for the previous 100/150 ka?

This chapter can not answer all these questions. Rather, it describes the latest finds in North Africa, particularly in northern Libya, which, for the period between 40 ka and 20 ka BP (Lower LSA), is not much, but is something that deserves our attention. It then continues with presenting another typical North African situation, that of the Iberomaurusian, or Upper LSA, which covers the last portion of the chronological timespan of this book.

The Lower LSA is mostly known from the Haua Fteah cave, located at the foot of the Jebel Akhdar in Cyrenaica, north-eastern Libya (Fig. 5.1). Some other sites have also been found and several dates were obtained for this period in the Jebel Gharbi, north-western Libya (Fig. 5.1). The human occupation spanning from *c.* 20 ka BP to 11–10 ka BP is much better represented all along the North African coast, but is completely lacking in the Sahara. Once again, there is no agreement on how to name this cultural entity. Iberomaurusian, Epipalaeolithic, late Upper Palaeolithic, and Upper LSA are the most common names, currently used to refer to the human groups living in North Africa during the final Pleistocene. The first name to be suggested was Iberomaurusian (Pallary 1909), but was contested because it implied connections between Morocco, hence the suffix ‘maurusian’, and the Iberian peninsula, that now can not be accepted. Nevertheless, taken the term Iberomaurusian alone, without assuming Iberian influences, it still has an intelligible cultural meaning. A more general term was Epipalaeolithic (*e.g.*, Roche 1963; Tixier 1963), due to the

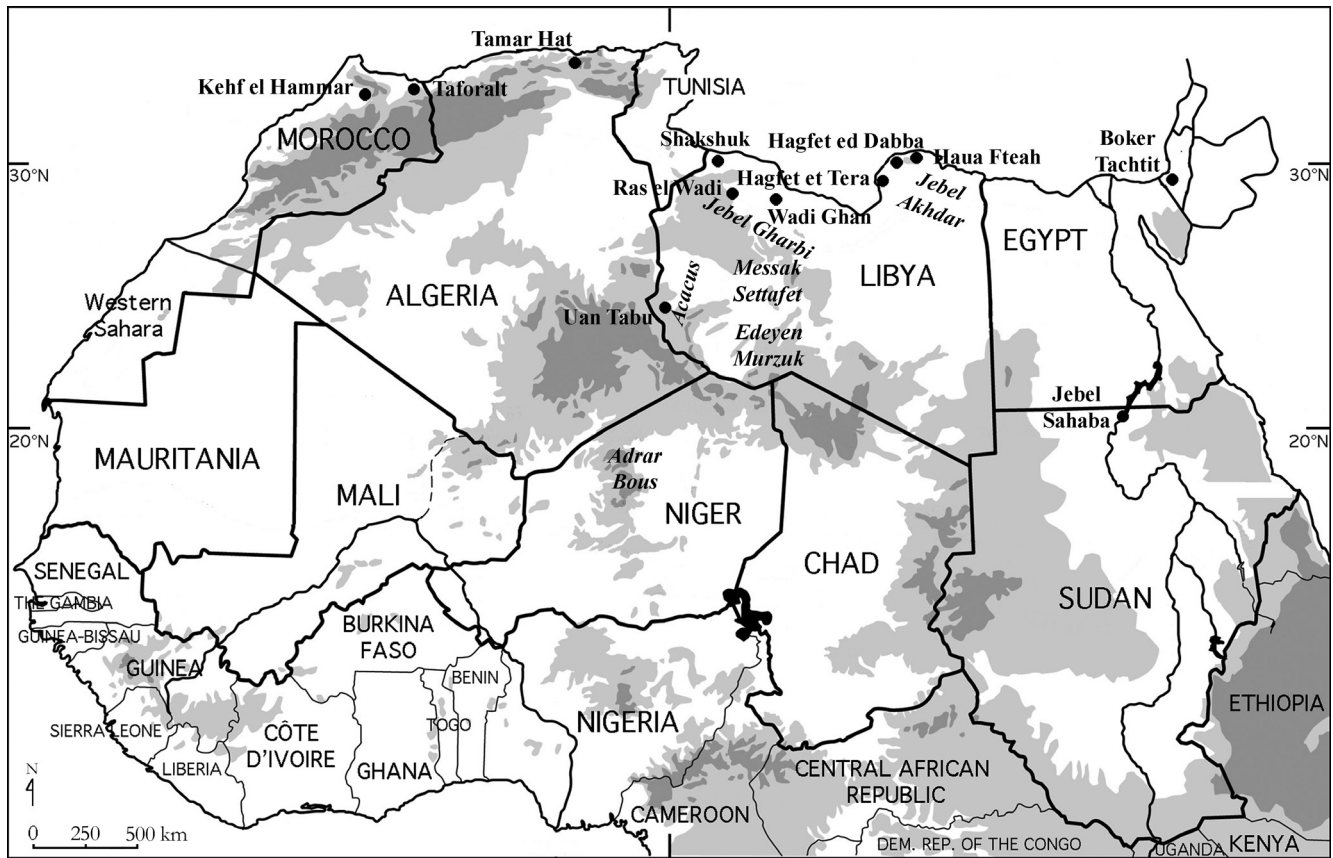


Figure 5.1. Map of sites cited in the text.

closer technological affinities of its microlithic assemblages with the Epipalaeolithic of Europe, but the recently acquired chronology has indicated much earlier dates than originally thought, in some places apparently beginning from *c.* 22 radiocarbon ka BP (*c.* 25 cal ka BP). In addition to them, there are other names, such as Oranian, Mouillian, Eastern Iberomaurusian and Eastern Oranian, that basically define local variations of analogous techno-complexes, which originated in areas outside the putative origin of the Iberomaurusian (Morocco).

North African climate and environment between 40 ka and 10 ka BP

One explanation for the end of the Aterian is the dramatic decrease in temperature at 44–43 ka BP, which approached those of the Last Glacial Maximum (LGM) (Lahr and Foley 2003). Conversely, the beginning of the Lower LSA can be related to a mild interval dated at 39–36 ka BP (Van Andel 1989; Van Andel and Tzedakis 1996). During this period, semi-desert conditions spread east of the Maghreb and in the Gulf of Sirte, Libya, and the sea level was up to 70 m

below the present level, uncovering extensive coastal plains (Van Andel and Tzedakis 1996). However, there is a seemingly gap of 4–8000 years between one event and the other without apparent unconformities in the geostratigraphic sequences. In fact, in various localities of northern Libya, including the Jebel Gharbi, a fault system active during the Upper Pleistocene produced high magnitude earthquakes that opened permanent outlets of underground aquifers and formed a series of springs (Ambraseys 1984; Suleiman and Dosers 1995; Garcea and Giraudi 2006). These water supplies supported a settlement pattern that was started by Aterian groups and remained in place through the LSA, and even later in the Neolithic and Roman periods, until the present time (Garcea 2009).

Another mild interval in North Africa is dated at 28–25 ka ago (Macklin *et al.* 2002). Favourable climatic conditions were also recorded at Haua Fteah, which yielded animal remains of megafauna, including mostly caprines, and smaller quantities of large bovines, hartebeest, and wild horse (Higgs 1967). It is possible that this second moister phase favoured the expansion of human groups further west, into the Jebel Gharbi (see below). Furthermore, even when

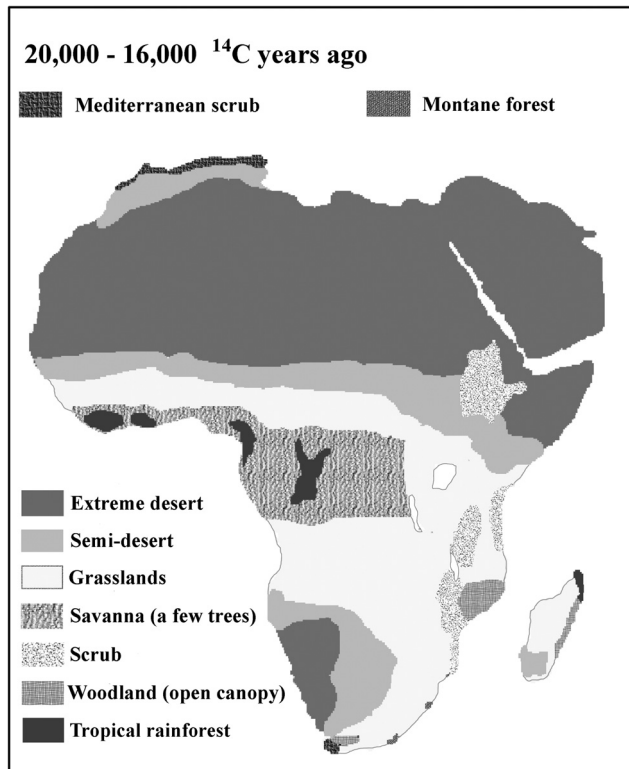


Figure 5.2. Map of the African vegetation at 20–16 radiocarbon ka ago (adapted from Adams 1998).

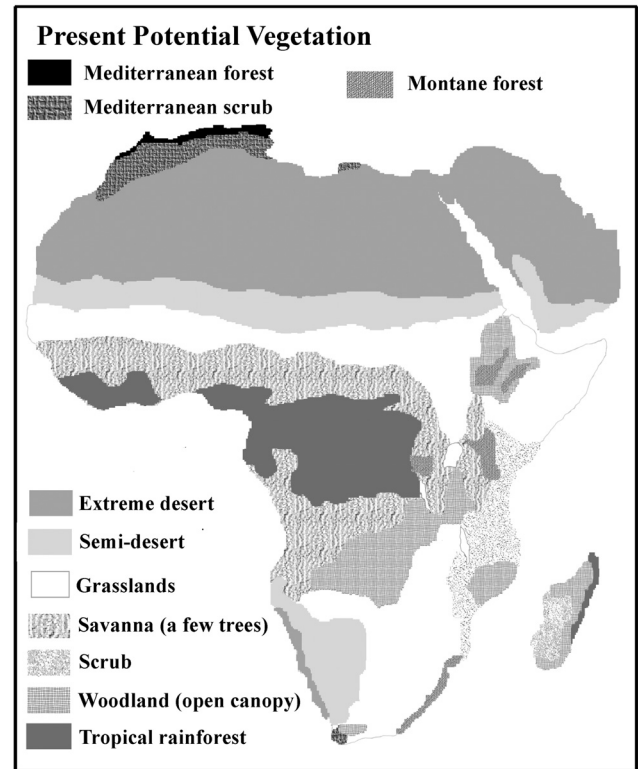


Figure 5.3. Map of the African vegetation at present (adapted from Adams 1998).

climatic conditions were less favourable, during MIS 2 (c. 24–11.5 ka BP), in the Maghreb, there was availability of water sources, vegetation, fauna and shelters, particularly in karst cavities (Michel and Wengler 1993). Thanks to these conditions, human occupation could persist throughout the final Pleistocene, giving rise to LSA cultures. During the Last Glacial Maximum, different vegetation biomes existed in Mediterranean North Africa. While a savannah-type of vegetation grew in the Maghreb proper, semi-desert and desert conditions developed in the Libyan littoral (Adams and Faure 1997). In the Mediterranean littoral of the Maghreb, between 20 and 16 radiocarbon ka ago (c. 23–19 cal ka BP) (Fig. 5.2), a Mediterranean scrub grew where now there is a Mediterranean forest (Fig. 5.3), and, in mountainous Maghreb, semi-desert conditions were in the place of the present scrub, whereas the desert encroached on the Libyan mountain ranges around the Gulf of Sirte (Adams 1998). A reconstruction of the vegetation cover at 18 radiocarbon ka ago (c. 21 cal ka BP) provided more detailed information on the geographical distribution of the different biomes: discontinuous patches of Mediterranean sclerophyll shrub were spread in parts of the Maghreb, whereas temperate semi-desert conditions, with sparse scrubland or grassland, and less than 2% cover of tall

vegetation, occupied the rest of the Maghreb, while a temperate desert, with a vegetation cover of less than 4% and very sparsely vegetated, cold winters, expanded in the rest of North Africa (Adams 1998). Winter rainfall providing moister conditions in restricted areas of north-western Maghreb did not precipitate east of the Maghreb (Hooghiemstra *et al.* 1992). The results of the CLIMAP project confirmed the presence of a shrub and low tree vegetation in the Atlas mountains, sparse grassland at lower altitudes, and desert conditions elsewhere (<http://ingrid.lidgo.columbia.edu/SOURCES/.CLIMAP/>, accessed March 2010).

Charcoal collected from the Iberomaurusian site of Kehf el Hammar, in the north-western Rif of Morocco, included Leguminosae, juniper and deciduous oak and pine, which are species that presently grow at altitudes above 1200 m. Their presence at the site indicated much cooler and drier conditions than today (Barton *et al.* 2005). Furthermore, oxygen isotope analysis of shells from Haula Fteah suggested that sea temperatures were 7–8°C below the present (McBurney 1967), as is confirmed by the CLIMAP estimates of 8–9°C (Close and Wendorf 1990). Temperatures in the Gulf of Sirte were always higher than in the Maghreb and, although some mountain headwaters at high altitudes in the Mediterranean basin were glaciated (Macklin *et al.* 2002),

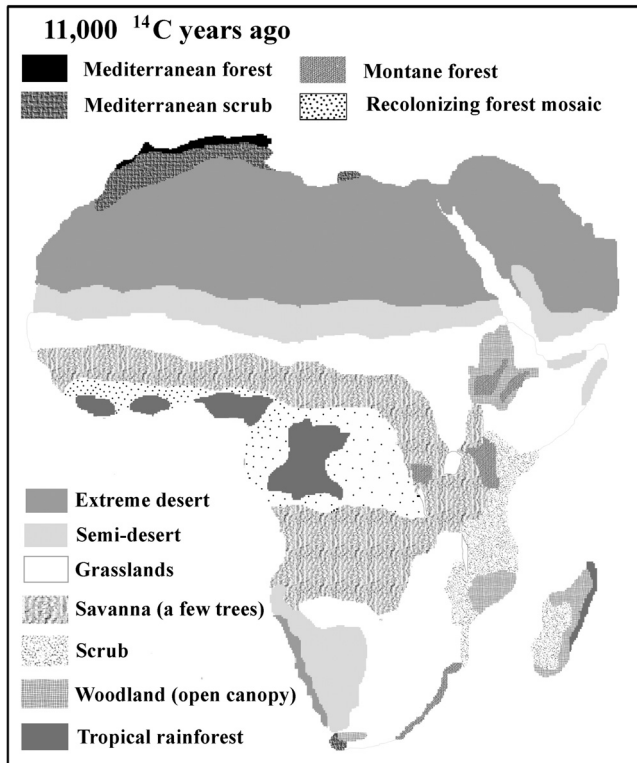


Figure 5.4. Map of the African vegetation at 11 radiocarbon ka ago (adapted from Adams 1998).

all those in the Libyan mountain ranges were below snowline. The Last Glacial Maximum ended around 15–14 ka BP and the climatic picture significantly changed with the initial warming and moistening at c. 12.5 radiocarbon ka BP (c. 14.5 cal ka BP). At this time, a cover of Mediterranean shrub developed in the Maghreb and the tropical extreme desert expanded northward, replacing the temperate desert that existed since 18 ka BP. By 11 radiocarbon ka BP (c. 13 cal ka BP), the vegetation in North Africa appeared very similar to the present one (Adams 1998) (cf. Figs 5.3 and 5.4).

Climatic conditions strongly affected animal resource availability and exploitation. Hunting of megafauna continued to be the major subsistence activity at Haua Fteah, with some exploitation of marine resources only in the late Iberomaurusian period, dating from c. 12 ka ago. Barbary sheep (*Ammotragus lervia*) continued to be the prevailing animal remains at Haua Fteah, in addition to gazelle, hartebeest, bovids, and equids (Higgs 1967; Klein and Scott 1986). As the age and sex profiles of Barbary sheep bone assemblages were similar to those of living populations, it has been claimed that they were hunted rather than herded (Close and Wendorf 1990), as previously suggested (Saxon *et al.* 1974). The predominance of Barbary sheep at Haua

Fteah and that of gazelle at the near-by site of Hagfet et Tera suggested that they depended on local availability, rather than on different subsistence economies (Close and Wendorf 1990). Preliminary faunal analyses from the sites in the Jebel Gharbi indicated that the African wild ass predominated in the faunal assemblage of the Iberomaurusian site SJ-00-56 at Ain Shakshuk, followed by gazelle, Barbary sheep and possibly hartebeest (Alhaique and Marshall 2009).

Industries and chronologies

The Dabban and the Lower LSA

The term Dabban, or Dabba culture, was proposed after the type site of Hagfet ed Dabba (Fig. 5.1), discovered in 1947 by McBurney in the Jebel Akhdar, not far from Haua Fteah, to define a blade industrial tradition following Middle Stone Age techno-complexes (McBurney and Hey 1955).

In reality, the lithic assemblage from Hagfet ed Dabba is less representative of the Dabban cultural complex than the industry later collected from Layers XXV–XXVI at the Haua Fteah cave (McBurney 1961, 1967) (Fig. 4.5; Garcea, Chapter 4). Here, the stratigraphic sequence suggested two phases within the Dabban. The Early Dabban featured small, almost microlithic, backed blades made by the soft hammer or punch technique, burins, small endscrapers, and flaked adze-like tools. Typical tools are the so-called chamfered blades, which are chisel-like burins on blades (Fig. 5.5, 2–3). Considering the small dimensions of the backed blades, McBurney (1967) suggested that they must have been mounted and assembled on composite tools. Hafting was probably also used on adzes and possibly other tools, as well. The Late Dabban showed an increase of scrapers and burins, and a decrease of chamfered blades, with a general shift toward broader pieces. Backed blades slightly decreased, but not significantly. The Late Dabban lithic tool-kit from Haua Fteah included grinding stones, as well.

McBurney (1967) observed such typological contrasts with the underlying cultural horizons of the MSA and the Aterian that he suggested a cultural replacement by groups skilled in the laminar technology. As he found analogies between the Dabban and the Emiran of the Levant, he thought that the newcomers in Cyrenaica came from the east (cf. also Bar-Yosef and Belfer-Cohen, Chapter 9). Near Eastern resemblances also appeared to J. D. Clark (1993), who compared the Dabban with the Ahmarian. He argued that the two traditions were broadly contemporaneous, but only the Ahmarian seemed to have a local predecessor, which was the southern Levantine Mousterian with a Levallois point technology. A certain degree of technological continuity in the production of Upper Palaeolithic types with Middle Palaeolithic techniques was also recognised at Boker Tachtit, in Israel (Marks and Volkman 1987).

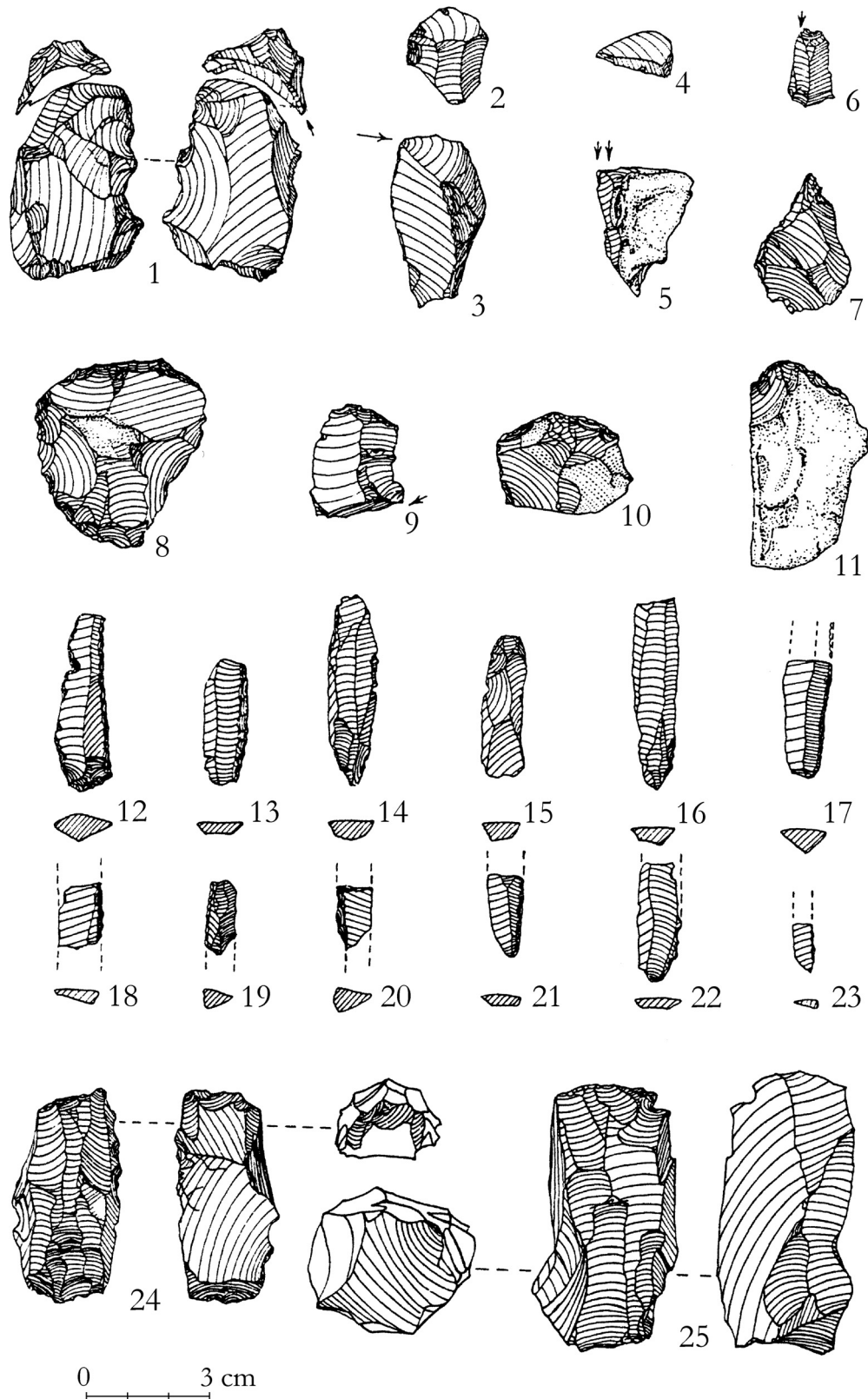


Figure 5.5. Early Dabban retouched tools from Haua Fteah (Libya): 1. Chamfered core-tool with fitting burin spall; 2–3. Chamfered blades; 4. Sharpening spall; 5–6. Angle burins; 7. Awl; 8–11. Endscrapers; 12–16. Backed blades; 17–23. Backed blade fragments; 24–25. Blade cores (adapted from McBurney 1967).

Cyrenaica was compared to the Levant because in both areas the blade technology followed the Middle Palaeolithic/Middle Stone Age within a short time (Marks 1975), even though there is a major human biological difference in the two regions that should not be underestimated. Technically, if biological continuity is plausible in North Africa, where anatomically modern humans existed since the beginning of the Middle Stone Age, a biological replacement took place in the Levant, where modern humans succeeded Neanderthals. During this period, Cyrenaica seemed to be more similar to the Levant than to the Maghreb and the Sahara, even though there were specific technological differences, namely a prevalence of backed blades and opposed platform cores with alternately struck blades in Cyrenaica, and rare backed tools and opposed platform cores in the Levant. Furthermore, Dabban endscrapers were completely different from the finely made pieces of the Levantine Aurignacian. All in all, only burins, and especially chamfered blades, were the most significant typological similarities between the Early Dabban and the Levantine Upper Palaeolithic (Marks 1975). However, these tools only occur in coastal Lebanon, but not in southern Levant, which would be closer to Africa (cf. also Bar-Yosef and Belfer-Cohen, Chapter 9). This could either suggest that some traditions simply diffused where they were functionally useful and culturally convenient, or that some sites are presently below the sea level, which temporarily uncovered extensive coastal plains during MIS 3 (Van Andel and Tzedakis 1996).

From both a chronological and technological point of view, some local traditions did not disappear from Cyrenaica between the last Aterian and the Early Dabban occupations. The changes in tool types and manufacturing techniques suggested transformations in the number and/or diversity of the skills that were performed. Therefore, the Dabban blade industry may have evolved from the local North African Aterian, or at least the human groups who inhabited that region underwent an endemic biological evolution. On the other hand, once anatomically modern humans were definitely settled in the Levant and the same, culturally alike, species occupied the entire territory – in and out of Africa – the African and Levantine Mediterranean coasts may have acted as open, two-way corridors. Within this scenario, Cyrenaica was placed in a privileged geographic position that was open to external influences that may have even originated as far as East Africa and reached the eastern Mediterranean coasts (Ambrose 1998; Bar-Yosef 1998), spreading east to the Levant and west towards the Maghreb. Vice versa, Levantine influences may have returned to Mediterranean Africa, reaching Cyrenaica first.

Moving just west of Cyrenaica, in the Jebel Gharbi, McBurney and his team found Lower LSA artefacts in the Wadi Ghan. They were scattered on the surface of terrace deposits containing Aterian implements (Hey 1962), which

provided evidence for a stratigraphic succession with the Aterian before this industry. Lower LSA materials were found again in the Wadi Ghan during more recent investigations (Barich *et al.* 2003a, 2003b; Garcea and Giraudi 2006). Another consistent evidence for Lower LSA occupations appeared at Ain Zargha (Ras el Wadi), where a stratigraphic series included a lower unit with MSA artefacts, an upper unit including a layer of colluvial silt and loess with Aterian artefacts, and a paleosol containing some Lower LSA artefacts. Furthermore, another Lower LSA site was located at Ras el Wadi (SJ-90-12). It contained artefacts included in a paleosol contemporary to the one identified in the sedimentary sequence mentioned above (Garcea and Giraudi 2006).

The Iberomaurusian and the Upper LSA

The Iberomaurusian (Upper LSA) is a microlithic complex, often made with the microburin technique, usually consisting of a very large quantity of backed bladelets and backed points, that can make up 40–80% of the tool-kits. Endscrapers, denticulates, notches and scaled pieces (Fig. 5.6) are common, as well as polished bone perforators and adornments (Roche 1963; Tixier 1967; Lubell 1990).

At Haua Fteah, the Iberomaurusian, locally called Eastern Oranian, is represented with a distinct lithic technology and typology in layers XV–XI, which appear to be in stratigraphic conformity with the underlying Dabban horizon (Fig. 4.5; Garcea, Chapter 4). McBurney (1967) interpreted such a technological difference as the result of a population replacement, and Close and Wendorf (1990) maintained that at least an external influence reached Cyrenaica and extended towards the western Maghreb. Therefore, Haua Fteah could have played a role in the westward movement along the littoral of Iberomaurusian groups that resettled in the Maghreb. Unfortunately, no compelling evidence allows to trace clear movements of the groups that reached and spread along the North African coast. Close (1978) also suggested that the long occupation of Haua Fteah during the Iberomaurusian reflected the existence of long-lasting traditions in the stylistic lithic technology, subsistence strategy, and settlement organization based on a regular reoccupation of the site. She also considered that the makers of the various Iberomaurusian facies were part of a single cultural group (Close 1986). The continuity that she observed in the Iberomaurusian and succeeding Capsian lithic complexes is now also confirmed on anthropological grounds, which show no population replacement from one period to the other (Irish 2000). In fact, the Capsian is the cultural unit that developed in North Africa during the early Holocene, from c. 10 ka BP. Its type site is located near Gafsa, in southern Tunisia and displays a microlithic assemblage with a more varied tool-kit than in the Iberomaurusian, including large backed blades, burins and, later, geometric microliths, as well.

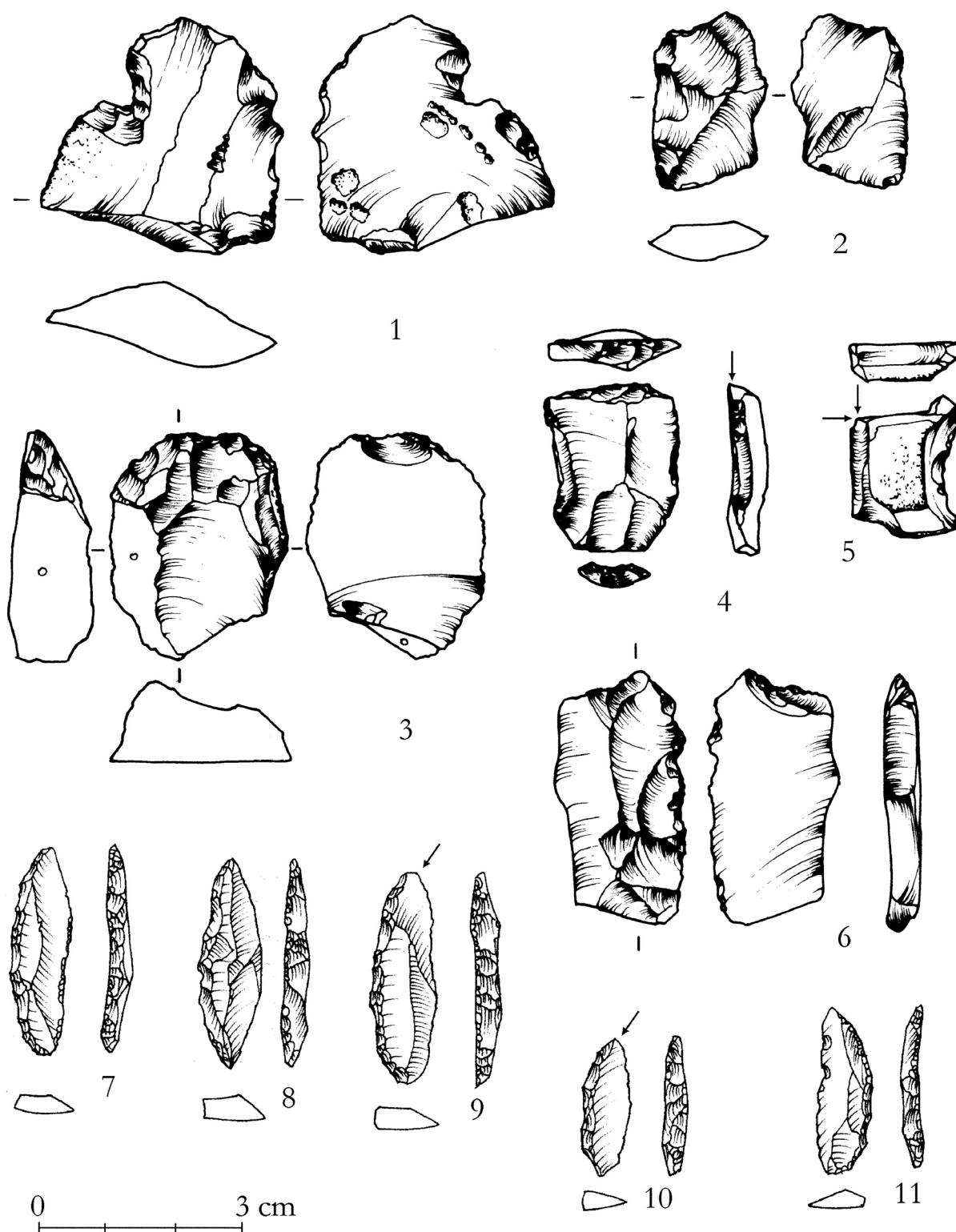


Figure 5.6. Iberomaussian retouched tools from Ain Zargha (Ras el Wadi): 1. Notched flake; 2. Scaled piece; 3. Endscraper on a retouched flake; 4. Angle burin on a truncation; 5. Dihedral burin; 6. Microburin; 7–11. backed bladelets.

The Iberomaurusian is well-represented in the Jebel Gharbi (Barich 1995, 2006; Barich *et al.* 2003a, 2003b, 2006; Barich and Conati Barbaro 2003; Barich and Giraudi 2005; Mutri and Lucarini 2008). Systematic investigations carried out in the mountain range and at the foot of the massif have offered a much broader regional framework of the settlement patterning and technical features of this period than in Cyrenaica. From a technological point of view, there are some differences from the classical Iberomaurusian tool-kits: backed bladelets do not predominate in all assemblages, whereas notches and denticulates can be the most represented tool class (cf., among others, Mutri and Lucarini 2008). Remains of marine shells of *Dentalium* sp., coming from the Mediterranean sea, located about 100 km from the mountain range, indicated either long-distance relations with different human groups, or exotic natural resources procurement (Barich *et al.* 2003b). The settlement pattern and tool variability suggested a functional specialization of the different sites in the various localities of the massif and its surroundings, with hunting, gathering, resource procurement, processing, and exploitation activities performed in the different sites, within a continual and systematic reoccupation of the area (Barich *et al.* 2003b).

The chronology of the Dabban

The earliest radiocarbon dates for the Early Dabban are 43,400±1,300 years BP from Haua Fteah (cf. the discussion by Marks 1975, 443), and 40,500±1,600 years BP from Hagfet ed Dabba, whereas the Late Dabban was dated at Haua Fteah to 33,100±400 years BP and 28,500±800 years BP (McBurney 1961, 1967).

In the Jebel Gharbi, the paleosol containing Lower LSA artefacts laid between two discontinuous layers of calcrete, the lower one being dated 27,310±320 BP by the conventional radiocarbon method and 30,000±9,000 BP by the U/Th method, and the upper one being radiocarbon dated

to 18,020±190 years BP (21,610 to 20,090 cal. years BP) (Barich *et al.* 2003a, 2003b; Garcea 2004, 2006; Barich and Giraudi 2005; Garcea and Giraudi 2006). Therefore, the Lower LSA occupation occurred during the timespan between c. 30 ka and 20 cal ka BP. This chronology suggests a hiatus between the latest Aterian, which lasted until around 40 ka ago, and the new groups producing Lower LSA techno-complexes. Therefore, compared to the Dabban of Cyrenaica, the Lower LSA in the Jebel Gharbi appears to be about 10 ka younger, being contemporary with the Late Dabban (Garcea 2004).

Other sites confirm the age of the Lower LSA in the Jebel Gharbi. At Shakshuk West (Site SJ-00-55 Test 2), a series of thin aeolian layers with charcoal appeared at the top of a soil with Aterian artefacts (Fig. 5.7). The upper part (0/-50 cm) of this deposit was dated to 24,740±140 and 25,500±400 years BP by the AMS radiocarbon method (out of calibration range), whereas the lower part of the sequence (-50/-90 cm) gave a radiocarbon age of 30,870±200 years BP by the AMS dating technique. An elongated blade, that could be assigned to the Lower LSA, appeared in the lower sequence, 55 cm below the present surface (Garcea and Giraudi 2006).

Another test pit was excavated on the right bank of Wadi Sel (Site SJ-02-68), a few hundred meters west from Ain Shakshuk. It brought to light a sequence with: (1) a layer with charcoal, corresponding to the Iberomaurusian site (SJ-00-56) excavated near-by (Barich 2006; Mutri and Lucarini 2008), (2) a sandy layer with an endscraper reworked on a Mousterian core and a crested bladelet, (3) a layer with charcoal and ashes, which included a Levallois flake, and (4) a sandy layer with several artefacts, including a denticulated truncation. Layer 3 evidenced a fault line caused by seismic activity. Layers 3 and 4 could be attributed to the Aterian and layer 2 was associated with the Lower LSA. Layer 3 was dated by the AMS technique to

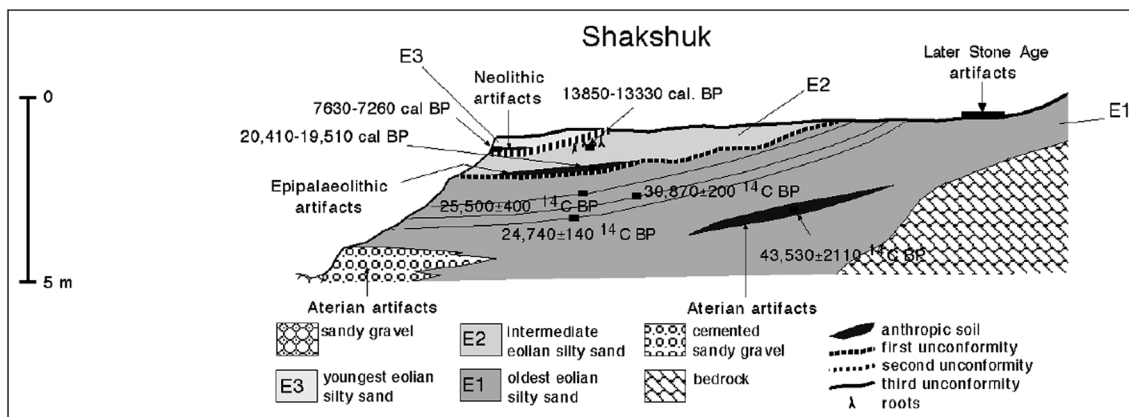


Figure 5.7. Stratigraphy of Shakshuk (Libya) (adapted from Garcea and Giraudi 2006).

44,600±2430 years BP (Garcea 2006; Garcea and Giraudi 2006). Finally, in the Wadi Basina, about 10 km further west from Shakshuk, a few Aterian artefacts were found scattered on a stone pavement indicating deflation activities, before the formation of a lacustrine horizon that formed between 26,330±80 BP and 18,760±50 BP years BP (22,740 to 21,820 cal. years BP) (Garcea and Giraudi 2006).

The chronology of the Iberomaurusian

The oldest radiocarbon dates for the Iberomaurusian are 21,900±400 BP from Taforalt, in the Beni Snassen mountains of eastern Morocco (Roche 1976), and 20,600±500 BP from Tamar Hat, in eastern Algeria (Saxon *et al.* 1974). Recently, Ghar Cahal and Khef el Hammar, in the north-western Rif of Morocco, and Taforalt have been accurately dated, or re-dated, with different dating techniques (Barton *et al.* 2005, 2007; Bouzouggar *et al.* 2008). At Khef el Hammar, AMS dates were compared with ages obtained by the OSL method, with which they substantially coincide. The AMS dates span from 21,900 BP (out of calibration range) to 13,300 BP (16.2–15.5 cal ka BP), and the OSL dates go from 23,400 BP to 13,400 BP. Calibrated dates indicate that the main occupation of the site took place between 17,170–16,670 and 17,040–16,550 cal years ago. New AMS determinations, at Taforalt, went from 17,500 radiocarbon years (21–20.4 cal ka BP) to 10,900 radiocarbon years (12.9–12.8 cal ka BP), and placed Ghar Cahal at the end of the Iberomaurusian occupation, dating from 11,100 radiocarbon years BP, or *c.* 13 cal ka BP.

Although McBurney (1967) suggested an age around 14 ka BP for the beginning of the Eastern Oranian at Haua Fteah, two other dates, of 18,620±150 BP and 16,070±100 BP, have been assigned to this cultural complex and have also suggested that they may not be the oldest ones (Close 1986; Close and Wendorf 1990). Therefore, it could be possible that this tradition may be older here than in the Maghreb. Moreover, the latest dates, around 12 ka BP, for the late Iberomaurusian at Haua Fteah corroborate a very long-lasting occupation of the cave.

The chronology of the Jebel Gharbi and surroundings adds new information on the settlement system of the Iberomaurusian. The earliest AMS radiocarbon date comes from Shakshuk (Site SJ-00-56) and is 16,750±60 BP (20,140–19,510 cal BP). Another relatively early one, from the Wadi Ghan (Site SG-99-41), made with the conventional radiocarbon method, is 14,820±60 BP (18,500–17,700 cal BP). The others are ~11 ka BP: at SJ-00-55 East, 11,690±40 BP (13,850–13,460 cal BP); at SJ-00-55 West (Test 1) 11,620±70 BP (13,850–13,410 and 13,350–13,330 cal BP); at SJ-00-55 East, 11,570±40 BP (13,820–13,630 and 13,550–13,410 cal BP); at SJ-00-55 East Hearth, 11,360±55 BP (13,330–13,110 cal BP); and at SG-99-41 11,110±40 BP (13,180–12,980 and 12,940–12,910 cal BP) (Barich *et al.* 2003b, 2006; Barich and Garcea 2008). This chronology and

the artefactual assemblages of the Iberomaurusian sites in the Jebel Gharbi show that this region was settled in a later phase than the sites facing the Mediterranean coast, although it was not isolated from the coastal sites, as the presence of marine shells indicates. As a matter of fact, a later expansion of the Iberomaurusian inland, as far south as the northern fringes of the Sahara, has been asserted with regards to other sites, such as Columnata, El Hamel, El Haouita, El Onçor and Es Sayar (Close and Wendorf 1990). Interestingly, the early sites were not abandoned, but were kept in use for several millennia, as shown at Haua Fteah. In particular, the period following the end of the Last Glacial Maximum witnessed a considerable demographic growth of a population that had already developed adaptive skills to adjust to semiarid environments. These skills became particularly useful when some groups settled in the interior.

Coping with droughts

The severe climatic conditions that appeared around 44–43 ka BP in North Africa caused significant population displacements, probably involving dramatic population reduction and isolation. Lower LSA sites are quite rare in North Africa, certainly less numerous than Aterian ones. The North African population contraction lasted until the emergence of the Upper LSA/Iberomaurusian which is much more widely spread. This event represents an unparalleled difference with respect to Eurasia, where population considerably increased from the beginning of the Upper Palaeolithic.

In some parts of North Africa, a long chronological gap separates the latest Aterian settlements, dating to *c.* 40 ka BP at the latest, from their successors. The Jebel Gharbi has provided hints for human occupations since about 30 ka ago, after a seemingly gap of some 10 ka. Further east, the Jebel Akhdar seems to be the only exception in this respect. The first Dabban occupations at Haua Fteah and Hagfet ed Dabba date from 40 ka BP and do not exhibit major interruptions with the previous Aterian. In fact, Dabban industries show a long continuity, of about 20 ka, with only a few shifts in the proportions of some tools, filling the timespan between the latest Aterian and the earliest Iberomaurusian occupations.

The Dabban and the Lower LSA of the Jebel Gharbi do not seem to show strict analogies in the Maghreb and appear as specific cultural complexes of the Libyan littoral. Nevertheless, some post-Aterian and pre-Iberomaurusian evidence for human occupation exists also in the Maghreb. In fact, an occupation horizon dated to 25.7 radiocarbon ka was found at Taforalt, below the Iberomaurusian sequence (Barton *et al.* 2007). Even though the geochronological data from the Jebel Gharbi provide a well-defined picture of the Lower LSA, the archaeological evidence and lithic techno-complexes are still too scanty to assess similarities or

differences with the Dabban of Cyrenaica. The apparent absence of human occupations during the period between 40 ka and 30 ka ago in the Jebel Gharbi may be due to the different ecological conditions in the massifs of Cyrenaica and Tripolitania. The Jebel Gharbi, with its lower altitudes and greater distance from the Mediterranean sea, was subject to a drier and less favourable environment.

Although the skeletal record of Aterian humans is extremely scanty, and no information is available on the population producing the Dabban complex, the Aterians seem to belong to the same robust Cro-Magnon type as Iberomaurusian populations (cf. also Hublin *et al.* 2010). The latter are much better represented, particularly at Taforalt, where a cemetery with some 200 individuals was excavated (Ferembach *et al.* 1962; Ferembach 1985), and at Afalou bou Rhummel, where 50 burials were found (Arambourg *et al.* 1934). Several individuals dating to this period missed their two upper incisors, showing that they were usually removed at puberty, according to a typical Iberomaurusian practise. Dental investigation has also illustrated that the Iberomaurusian individuals from Taforalt were more closely related to the successive Capsians and Berbers than to the Nubians from Jebel Sahaba, Sudan, and that the supposedly common Mechta-Afalou population can no longer be supported. Furthermore, it has been demonstrated that at least some Iberomaurusians, such as those from Taforalt, evolved locally (Irish 2000). Therefore, the chronological gap between the latest Aterian and the earliest Lower LSA populations does not reflect a biological replacement of new groups anatomically different from the previous inhabitants.

In conclusion, northern Libya appears to have been a critical area in the population history of the late Upper Pleistocene of the southern coast of the Mediterranean. It probably received some external influences that contributed to the development of the Dabban first and the Iberomaurusian later. As the Iberomaurusian assemblages are very similar in both the eastern and western parts of North Africa, they suggest that the peoples of North Africa shared common traditions that first spread along the Mediterranean littoral.

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Middle and Upper Palaeolithic in the Egyptian Nile Valley

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In any study related to Egypt, one should take in account that Egypt is larger than the Nile Valley itself. Egypt encompasses also the deserts east and west of the Nile (Fig. 6.1). The natural environment available for humans is very different in each of these regions. It would, moreover, be a mistake to presume that the prehistoric environments were always similar to the present ones. There is no doubt that, in the past, the Egyptian environment has been subjected to very important changes, which are discussed in Jennifer Smith's chapter (Chapter 2). In this contribution I will try to give an overview of what is known of important Middle and Upper Palaeolithic sites in the Egyptian Nile Valley, mainly Middle and Upper Egypt, with special reference to flint mining and burial practices. I will leave out the Western and Eastern Desert, which are well covered by other

publications (Wendorf *et al.* 1993; Vermeersch 2008, submitted).

Handaxes, mainly attributed to the Late Acheulean have been collected in the Lower Desert all over the Nile Valley. Only a single site, that of Nag Ahmed el Khalifa, has been excavated (Vermeersch *et al.* 2000b). The site consists of an artefact concentration with many bifaces inside a gravel deposit, not any more *in situ*. All other Lower Palaeolithic remains are to be considered as scattered over the surface of the lower desert in mainly isolated occurrences. The high number of such artefacts suggests that the occupation during the Lower Palaeolithic was important. Erosion however prevents any chronological, environmental or cultural interpretation of the Lower Palaeolithic presence of humans in the Nile Valley.

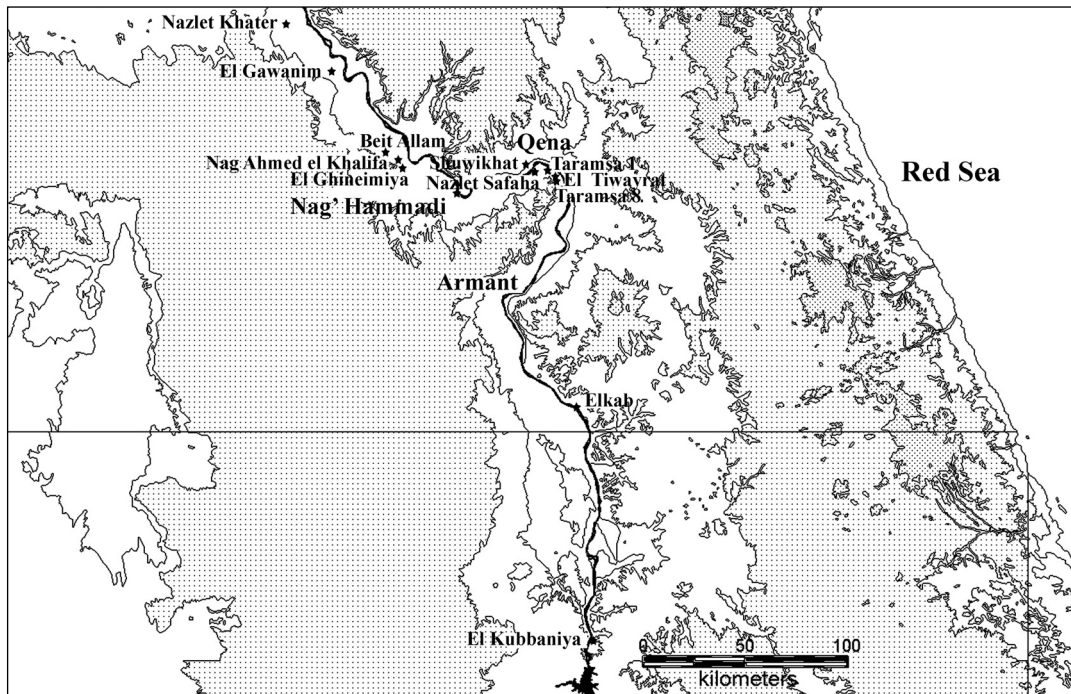


Figure 6.1. Map of Upper Egypt with the position of the important sites.

Middle Palaeolithic

Butzer and Hansen (1968, 158) observed that “The most common prehistoric remains in southern Egypt are flakes and flake tools of Middle Palaeolithic type. These are found scattered through the desert hills and plains on both sides of the Nile Valley.” Living sites of the Middle Palaeolithic are extremely rare or even absent in Egypt. Most information is available from flint extraction sites which are numerous. In the past, prehistoric studies have only incidentally shown some interest in understanding the flint¹ exploitation techniques in Egypt. However, huge quantities of flint were used in prehistoric periods. In Middle and Upper Egypt, the Nile Valley is entirely bordered by huge limestone cliffs formed by the Thebes Formation, which consists of thick massive white to yellow limestone including different layers of flint concretions and some marl (Said 1962). The local supply of coarse material derived from the plateau and scarps by wadi and slope erosion characterizes large areas of the lower desert creating local wadi terraces, which are often very rich in flint cobbles. In the past the wadi terraces have often been considered as Nile terraces with a chronological connotation, which is most often not the case. The terraces have been exploited by humans in search for flint. By evaluating the availability of good quality flint, it is important to observe that the terraces are characterised by an intensively weathered upper mantle. In the upper 50 cm of these terrace deposits, all flint cobbles are entirely broken up by salt and heat weathering, making them unsuitable for knapping. The intensive collecting of abundantly available raw materials without the presence of extraction features is recognized in the field by huge amounts of flaked material. Verri *et al.* (2004) have shown that the raw material, used to manufacture artefacts of already 300 ka old from Tabun Cave, Israel, was flint originating from layers, two or more meters deep, possibly mined or quarried by humans.

We have surveyed large areas of the Lower Desert on the left Nile bank opposite Qena, which are covered by local terrace deposits, which are very rich in flint cobbles of good knapping quality. Such surfaces are easily recognisable by the black patina that has developed on their surface. All over small to large pits (Fig. 6.2) have been dug by Middle Palaeolithic humans in order to extract flint cobbles that have been transformed on the spot into cores of which many are Levallois cores (Vermeersch and Paulissen 1997b).

Nazlet Khater 1 (Vermeersch *et al.* 2002), near Tahta, is situated in and on top of a small Nile terrace remnant (Fig. 6.3). Prehistoric humans exploited the cobbles of an active Nile branch. The upper part of the Nilotic gravel deposit, rich in flint cobbles and partially covered by Nile silts, contains numerous ($> 100/\text{m}^2$) Middle Palaeolithic artefacts. At Taramsa 1 (Fig. 6.4) a long history of extraction activity starting from the Lupemban could be documented (Van Peer *et al.* 2010).

The earliest Middle Palaeolithic assemblages of the Egyptian Nile Valley are similar to those that were made in Middle Stone Age industries of sub-Saharan Africa (Van Peer *et al.* 2003). According to Van Peer (2004) the widely distributed Lupemban technology of sub-Saharan Africa gives way to a regionally distinct facies in the lower Nile Valley by the onset of the Upper Pleistocene. This is the early Nubian Complex (Van Peer 1998) of which the lithic technology is characterized by the presence of a Levallois reduction strategy (Guichard and Guichard 1968) mainly for point production (Fig. 6.5). No living sites of this early Nubian Complex have been excavated in Egypt. However all over the lower desert along the Nile Valley important remains of this industry have been observed. Foliates and lanceolates are often found scattered in the desert, but along the Nile the earliest extraction traces at Taramsa 1 are characterised by the presence of such tools (Van Peer *et al.* 2010). An exceptional lanceolate from Taramsa 8 (Van Peer *et al.* 2008), found broken in two parts among its production flakes, shows marks of hafting. It indicates that complex tools were produced at the workshops, probably to be exported to living sites, which still are not found.

Towards the end of MIS 5, there are sites with late Nubian Complex assemblages in which bifacial foliates are now absent. Only points elaborated on mostly Nubian Levallois blanks are now documented (Van Peer 2004). At valley workshops, such as Nazlet Khater 1 and 3 (Vermeersch 2002a) and Taramsa 1 (Vermeersch *et al.* 1997a), the proportions of different technological categories reveal spatial dynamics for lithic products. Indeed, Nubian Levallois cores and their production waste occur in large numbers whereas Nubian points are rare. Conversely, there are too many Levallois flakes for the small amount of flake cores that are present (Van Peer 1998).

In the Nile Valley during MIS 5 the river morphology was probably quite similar to the present day situation with a meandering Nile evolving in a large valley that regularly was inundated by high water floods. As we have no living sites from that period we presume that the subsistence activities of the humans were similar to those that were in use at the oases of the Western Desert (Wendorf and Schild 2005): fishing, hunting and collecting in the Nile Valley.

Systematic quarrying resulted, in addition to the characteristics of the former extraction type, in well-delimited open-air features, which were dug to quarry the raw material. A very simple method of extracting was observed at Beit Allam (Otte *et al.* 2002). The Beit Allam site is embedded in wadi deposits, resting on top of consolidated coarse sand, which covers a layer of large well-rounded ellipsoidal flint cobbles (Fig. 6.6). The site was eroded by a wadi, probably roughly contemporaneous with its extraction period, resulting in the exposure of the cobble layer. Middle Palaeolithic people, in search for a good quality flint, passed by and observed that the fresh flint cobbles were eroding from the deposit.

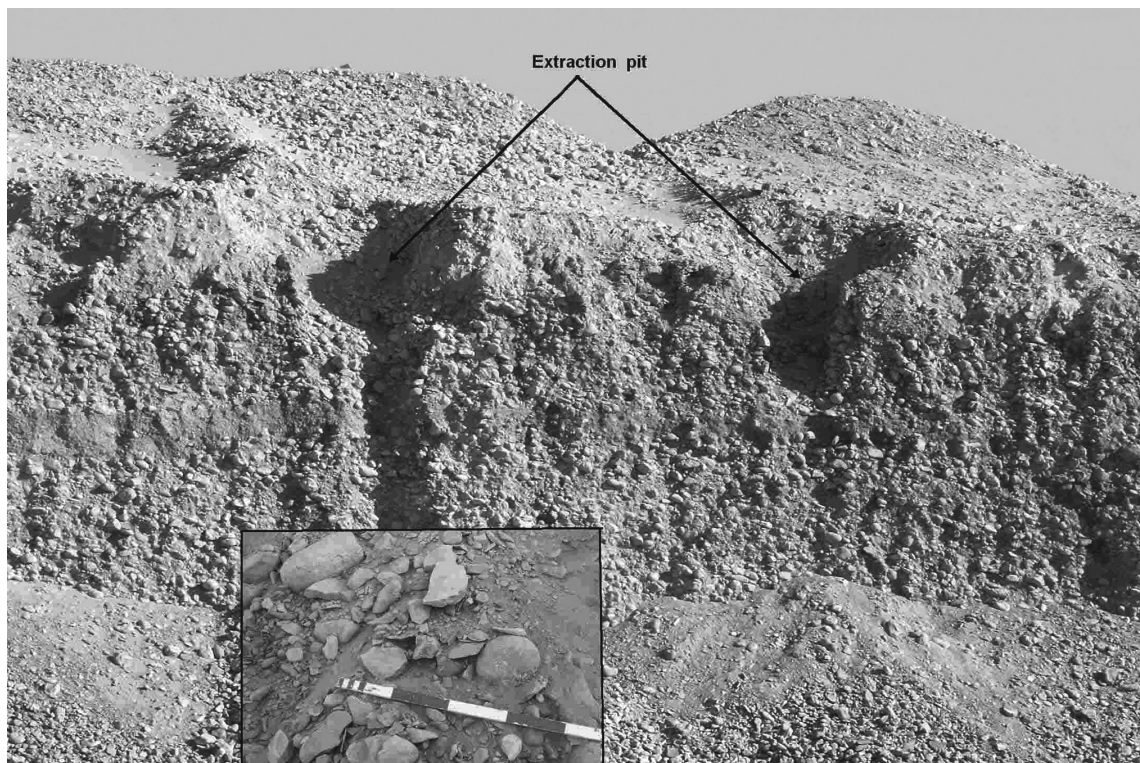


Figure 6.2. Extraction pits with Middle Palaeolithic artefacts (visible in the dump along the road) along the desert road from Dendara to the South. The unconsolidated fill of the pits were emptied while the road was cut into the terrace deposits.



Figure 6.3. The site of Nazlet Khater 1.



Figure 6.4. The Taramsa hill at the start of the excavations.

They started to enlarge the natural exposure, creating an extraction front (Fig. 6.6, between 4, 7 and 8) from which they extracted fresh flint cobbles. Knapping was performed directly on top of the terrace. The lithic material of this assemblage is assigned to the Lower Nile Valley Complex (c. 70 ka BP). The artefacts recovered from the excavation clearly suggest that the extraction activity and especially the production of Levallois end-products was the main activity. No traces of any domestic activity were found.

More complex extraction strategies are adapted to the characteristics of the ancient terrace deposits with their weathered cap. Prehistoric people first had to realise that below the weathered cap, there existed a possibility to uncover good flint cobbles. We, of course, have no idea how Middle Palaeolithic humans were reasoning and organising their survey for locating a good place for extracting, but they did not proceed with a random and unreasoned judgement. They probably used an approach similar to our own survey procedures. A good understanding of the local geomorphology and geology is a condition for success. This implied an evaluation of not only the thickness of a gravel deposit but also of its petrographic composition.

Extraction with pits is extremely frequent in the areas suitable for such extraction. In the Dendara area we even came to the conclusion that nearly all Pleistocene terraces have been exploited by Middle Palaeolithic humans. Among the oldest pit extraction sites we should refer to the sites Taramsa 3 (Vermeersch and Paulissen 1997b) and Taramsa 8 (Van Peer *et al.* 2008), which belong to the Last Interglacial period. Small extraction pits, not larger than a few square metres and reaching down into a gravel terrace, characterise the sites (Fig. 6.2). Prehistoric humans apparently already applied some quality control on the extracted cobbles (Vermeersch 2005). Each cobble of suitable dimension was hit with a hard hammer producing a single flake. A qualified knapper knows that, with such a procedure, one recognises the sound of a good homogeneous flint. Numerous cobbles, from which only a single flake was detached, are found in the extraction pits, the result of such a quality control. The extracted cobbles have been transformed into cores, of mainly Levallois method. The end-products have been exported to living sites, which have not yet been discovered.

In the area of Nazlet Safaha (Fig. 6.1), downstream of

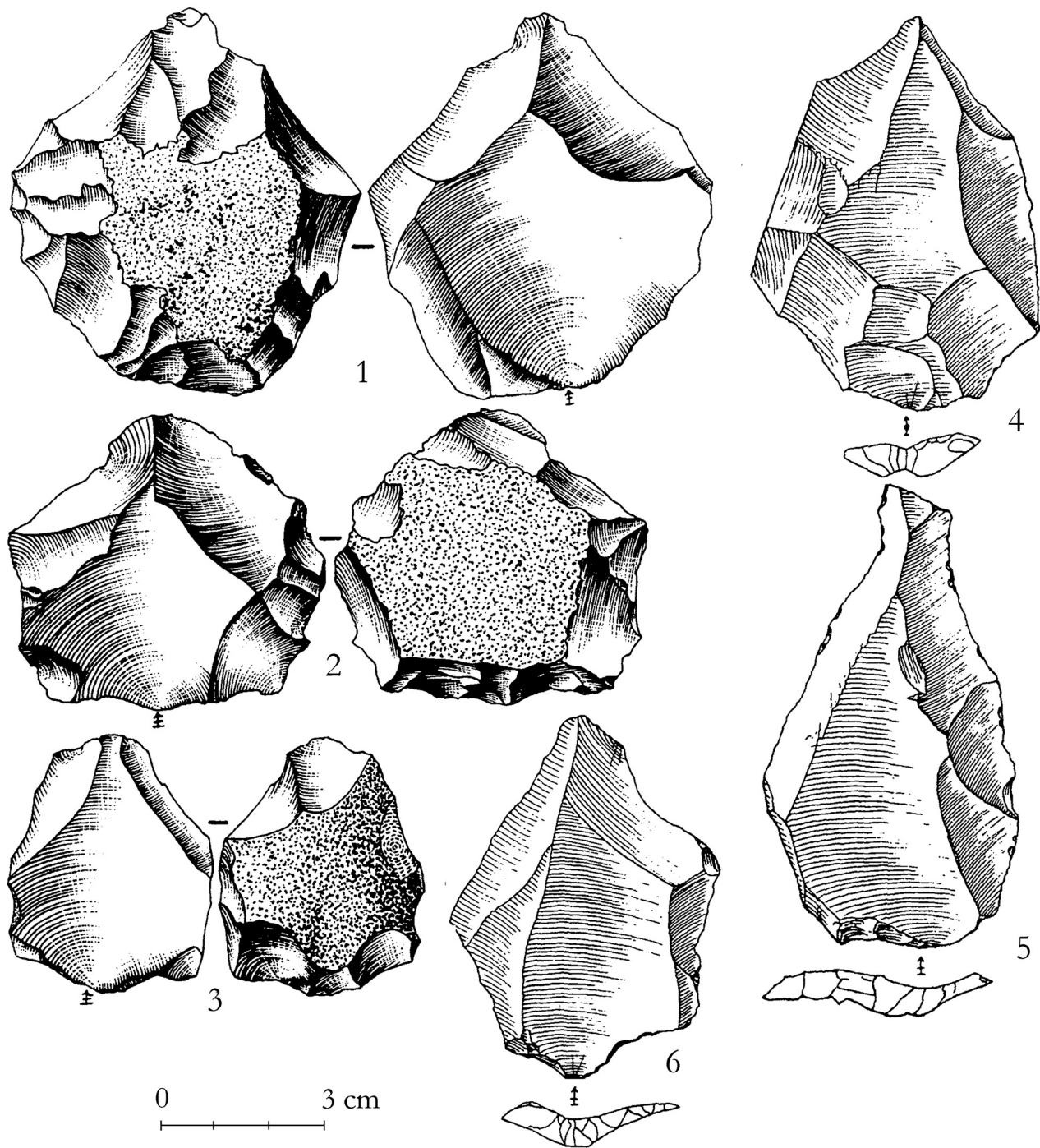


Figure 6.5. Nubian Complex cores and points from Nazlet Khater 1.

Dendara Temple, a 3000 m² large Middle Palaeolithic quarrying site from the Safahan, a late Lower Nile Valley Complex, was examined (Van Peer *et al.* 2002). The terrace deposits contain mainly metamorphous and eruptive materials, but also quartz and round or ellipsoidal flint

cobbles, the latter with diameters up to 0.2 m. The cobble deposit is overlain by about 0.5 m of sterile sand. Prehistoric humans (from *c.* 60 ka ago) extracted the flint cobbles by means of an open ditch and pit system with a maximal depth of about 1.7 m. The ditches have an irregular plan (Fig.

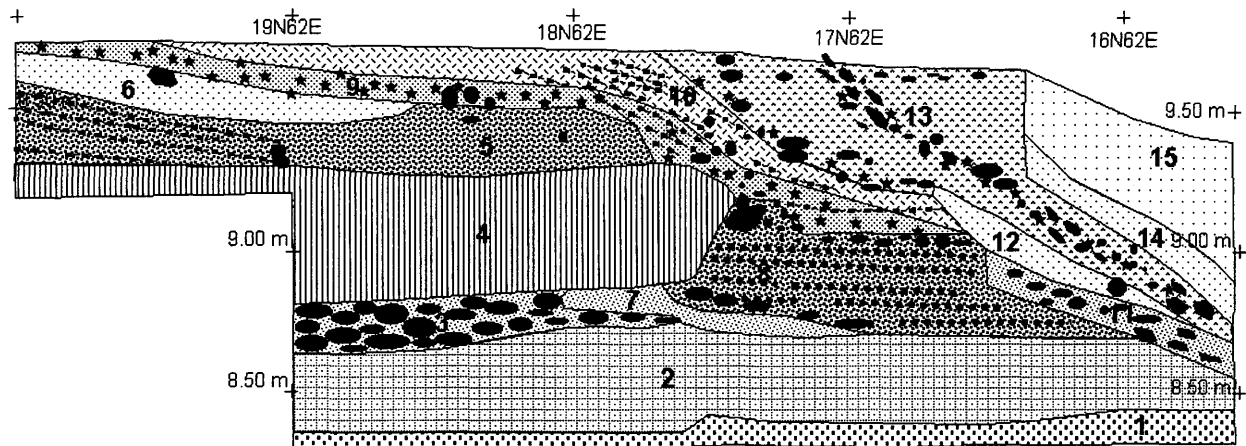


Figure 6.6. Stratigraphy of Beit Allam with the position of the exploited undercut cobble layer (3) and the knapping area (9).

6.7), with many tentacles and bulges. They exhibit vertical walls with only minor undercutting. The ditch width varies from about 1.0 to nearly 2.0 m. Field evidence shows that Middle Palaeolithic humans proceeded from a sub-vertical extraction front composed of sterile sand at the top and the upper part of the cobble terrace, exploiting the latter for a depth of about six cobbles. No excavation tools have been recovered. This may mean that excavation tools did not exist or that they were made from organic materials such as wood, bone or horn, which have not been preserved. During extraction, man sorted out the flint cobbles and sometimes also the largest quartz pebbles. Cobbles of other materials were dumped in the immediate vicinity. Middle Palaeolithic ateliers are incorporated in the ditch infillings. As a whole, the quarrying site gives the impression of being rather unstructured, probably as a result of intermittent exploitation. Discovery of this area by prehistoric man and access to the cobble deposit was probably due to the fact that the River Nile was eroding the terrace deposits, which thus became visible in the riverbanks. Still, to uncover the precise location of where to dig, prehistoric humans had to apply some geologic thinking in order to start digging in an area where no usable cobbles were visible at the surface.

Several distinct activity zones can be recognised at the site. In one of such zones, production activities have been organised in a circular spatial pattern. Starting from an extraction front, further production stages evolved in clockwise direction until exhausted products were finally abandoned near the extraction front. Furthermore, there was a spatial differentiation between discoidal flake productions (both Levallois and discoidal reduction systems) and blade production. It is clear that Levallois cores and end-products were exported. Some few data, such as the presence of tools, suggest that the exploitation sites were short-term living sites at the same time. We might assume that the presence

of large quantities of knapping debris, but also of the finished objects, such as Levallois flakes, could have its explanation by accepting that the knapping traditions have been transmitted during learning sessions. Is it unthinkable that good knappers gathered with young people to initiate them into the art of flint working? In this hypothesis, sites such as Nazlet Safaha and many others have been visited not only in order to collect the necessary raw materials, but also in order to teach young people how to shape and make a Levallois flake. There was no need to export the flakes or to use them. Prehistoric humans were only interested in making them.

With MIS 4 a long period of hyper-aridity sets in northern Africa and the conditions for humans in those regions must have become very hard. Consequently, after 70 ka the human occupation of the desertic areas outside the Nile Valley came to an end. In the Nile Valley technological changes are attested: the Nubian point lithic technology disappears and a number of industries, the Lower Nile Valley Complex, with only flake Levallois reductions such as the K-group (Van Peer 1998) from Nazlet Khater 2 and from Beit Allam (Otte *et al.* 2002) and the Safahan (Van Peer *et al.* 2002) from Nazlet Safaha (Fig. 6.8) are established. The lithic production system of Lower Nile Valley Complex industries is based on the Levallois concept in its classical form, supplemented by single and opposed platform reduction either of blades or microblades (Van Peer 2004). While Nubian Levallois points are not anymore produced, the Nubian method of core preparation is employed in the so-called Safahan method (Van Peer 1991). Here, the last step of the preparation sequence of a Levallois surface consists in removing a Nubian central ridge by an axial blow from the distal striking platform of the core. The Levallois flake, which is subsequently struck from the main striking platform, shows a double-pointed tip.

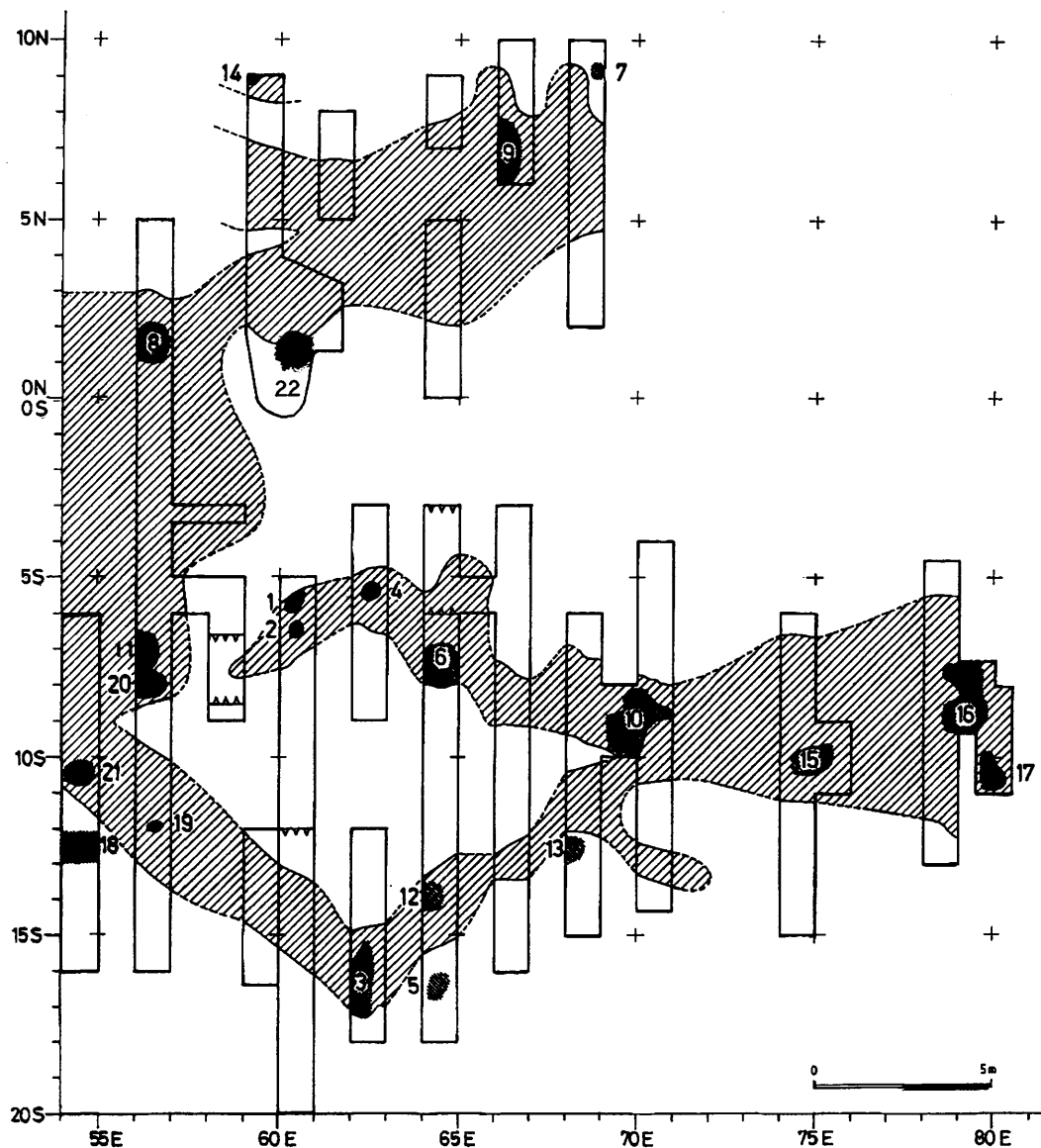


Figure 6.7. The lay out of the extraction trenches at Nazlet Safaha 2, with numerous flaking areas (numbered).

The age of these industries is still not well defined but an OSL date of $59,800 \pm 6600$ BP from aeolian sand, filling a prehistoric extraction ditch at Nazlet Safaha 2 is a good measure of the age of an assemblage belonging to the Safahan (Stokes and Bailey 2002; Van Peer *et al.* 2002). At Nazlet Khater 2 an age of $>35,700$ BP was obtained. The distribution of the Lower Nile Valley Complex is, according to Van Peer (2004), limited to Upper Egypt and Nubia, but assemblages such as that from Abu Suwair (south-eastern edge of the Nile delta) may belong to the Lower Nile Valley

Complex. Other sites (Fig. 6.1) are probably El Ghineimiya 2, El Gawanim 1 (Vermeersch *et al.* 2000a).

The Khormusan (Marks 1968), characteristic for the Second Cataract environment, is missing in Egypt with the exception of a small assemblage situated on top of the Mousterian silts at Wadi Kubbaniya, site E-82-4, where it is dated between 65 and 45 ka (Wendorf and Schild 1989).

All over the Nile Valley, it seems that extraction sites are less frequent than during the previous period, suggesting a population reduction in the valley.

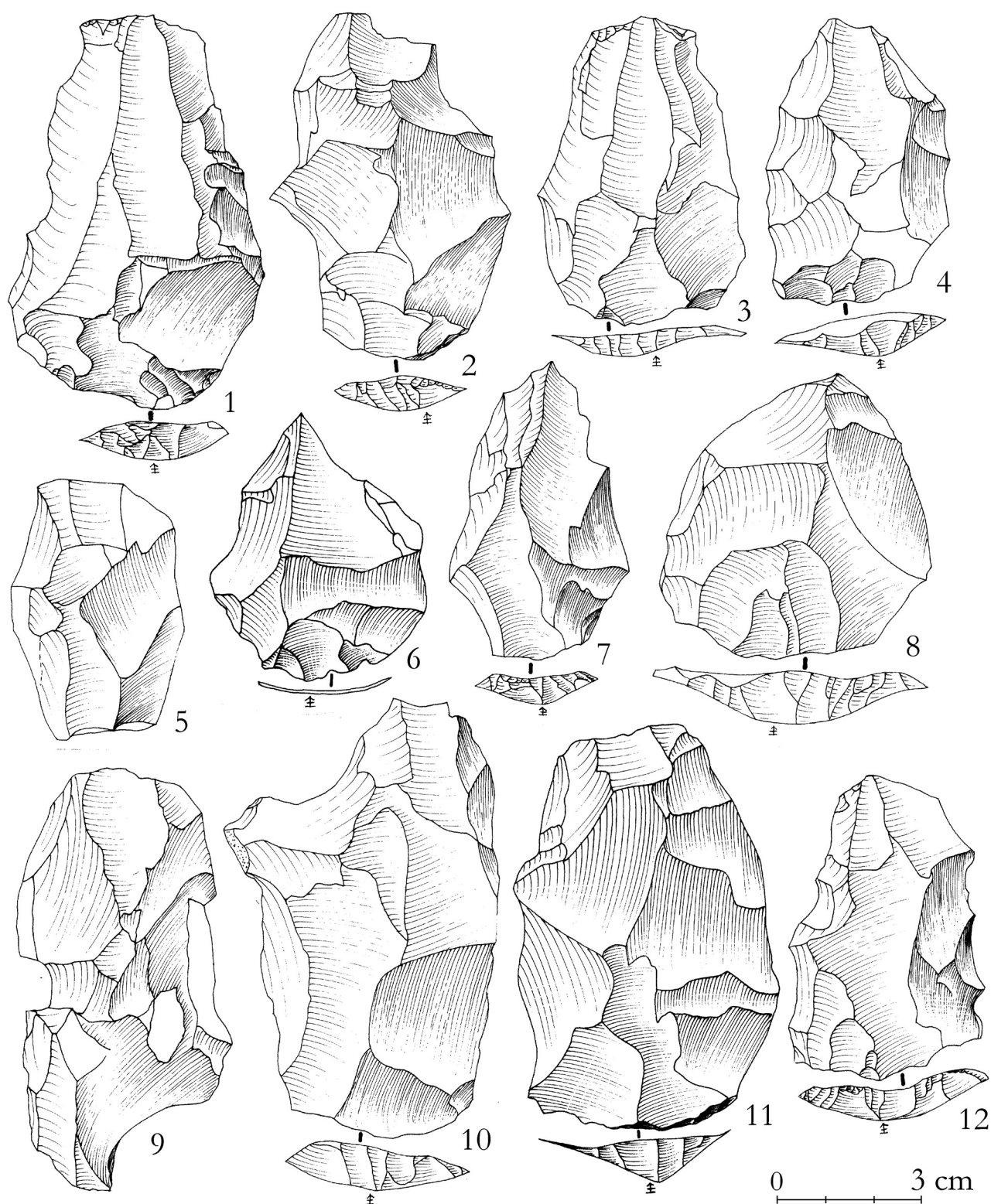


Figure 6.8. Safahan Levallois end-products from Nazlet Safaha 2.

Middle/Upper Palaeolithic transition in Egypt

A technological change is certainly attested in the Taramsan industry (Vermeersch *et al.* 1997a). According to Van Peer (2004) the Taramsan pinpoints the origin of an Upper Palaeolithic technology from its Middle Palaeolithic base. The Taramsan reduction systems, studied by means of completely refitted sequences, represent an adaptation of the classic Levallois surface exploitation to volume exploitation. The reduction starts out as a Levallois core preparation which is subsequently turned into a core with continuous blade-production from opposed striking platforms obtained by enlarging the available exploitation volume by creating an extremely domed upper core surface (Figs. 6.9 and 6.10). Van Peer (2004) considers that, on the basis of technological evidence and comparison with the Emiran, the initial stimulus for change in the Levant from the Nile Valley cannot be refuted. Moreover, the transition at Taramsa is certainly older than at Boker Tachtit (Marks and Kaufman 1983). Apparently, the Taramsan was produced by a highly organized society that started experimenting with alternative lithic production systems, a process that would result in fully Upper Palaeolithic blade technology as evidenced in more recent exploitation pits at the same site.

For Nazlet Safaha 1, the number of extracted chert pebbles of sufficient quality for reduction has been estimated at 190,000 (Van Peer *et al.* 2002). Accounting for a reliable selection ratio of 1 to 10, the total number of extracted nodules at these same site amounts to 1,900,000. A similar exercise for the Taramsan phase at the Taramsa 1 workshop suggests around 3,000,000 pebbles (Van Peer 2004) as a conservative estimate. Knowing that in the valley stretch between Luxor and Qena numerous other workshops from this period are present (Vermeersch 2002a), we can safely assume that total number of dug-out chert volumes would easily run over 100 million and perhaps much more, for this small region alone. Under this interpretation, the Lower Nile Valley during MIS 4, influenced by an important migration of people coming from the East and the West, where living conditions became unbearable because of the climatic deterioration, can be conceived as a region where technological experiments took place.

Associated with the Taramsan is the burial of a six-year-old child (Vermeersch *et al.* 1998). The skeleton was in a seated position (Fig. 6.11). The legs were bent to the left in a pronounced contracted position. The skeleton was leaning backwards, oriented towards the east, and with the head oriented skywards, resting upon a sand bed containing fewer cobbles. The left arm was also bent, resting upon the pelvis. The right arm was stretched down behind the back of the skeleton. The skeleton is poorly preserved and very fragile, the skull being the best-preserved part of the body. The skeleton was surrounded by extraction dump deposits of gravely sand, mixed with numerous artefacts. From the

seated position of the skeleton and its dump environment, an intentional burial is assumed. The body was simply laid down against the side of the extraction pit and covered up by the extraction dump mixed with artefacts. Because of its shallow position, at a depth of no more than 1 m below surface, we exclude the possibility that the person had died by accident due to the collapse of the pit walls. The age of the burial is still in discussion. When the burial was published in *Antiquity* (Vermeersch *et al.* 1998), we presumed that it dated at about 55,500±3700 BP, which was the weighted average of the then available OSL dates of the youngest extraction features on the Taramsa 1 site. As such dates were only circumstantial approaches, we tried to improve the dating of the burial by different approaches, including the stratigraphy and new OSL dates from the deposits above and below the burial and from sand inside the skull. The results of those dating approaches are contradicting. We now suggest, mainly relying on the artefacts included in the burial fill, that the burial is about 75 ka old, coeval with phase III at Taramsa 1 (Van Peer *et al.* 2010).

The skeleton appears to belong to an anatomically modern *Homo sapiens* (Vermeersch *et al.* 1998). Many features seem to be close to those of the robust Epipalaeolithic populations of North Africa ('Mechoids') but also to those of the early anatomically modern humans of the Levant. This skeleton is important as it documents the Late Pleistocene human population of the Nile Valley, of which little is known. It has to be viewed against the background of the dispersal of modern humans from Africa.

"Out of Africa" of modern humans and Egypt

There is now some agreement that the "Out of Africa" of modern humans happened at the level of the Middle Palaeolithic or Middle Stone Age. When considering an approach of the Out of Africa on basis of the environmental conditions, it seems that with the wet climatic conditions of the Last Interglacial, human populations in East Africa began to expand, pulled by the expansion of savannah and woodland habitats and increasing water resources. Populations became increasingly mobile and, according to Basell (2008), this is reflected archaeologically in the lithics, raw material use and increasing variability of site locations. The presence of refugia in Africa has been debated in relation with the occurrence of one or more bottlenecks for the existence of which one of the most common explanations is rapid climatic fluctuation, or aridity associated with glacial periods (Ambrose 1998). We believe that the Eastern Desert can not be considered as such a refugium. Still, according to some authors (Field and Lahr 2005; Hua Liu *et al.* 2006) the Red Sea coast was an important route "Out of Africa". However, with the exception

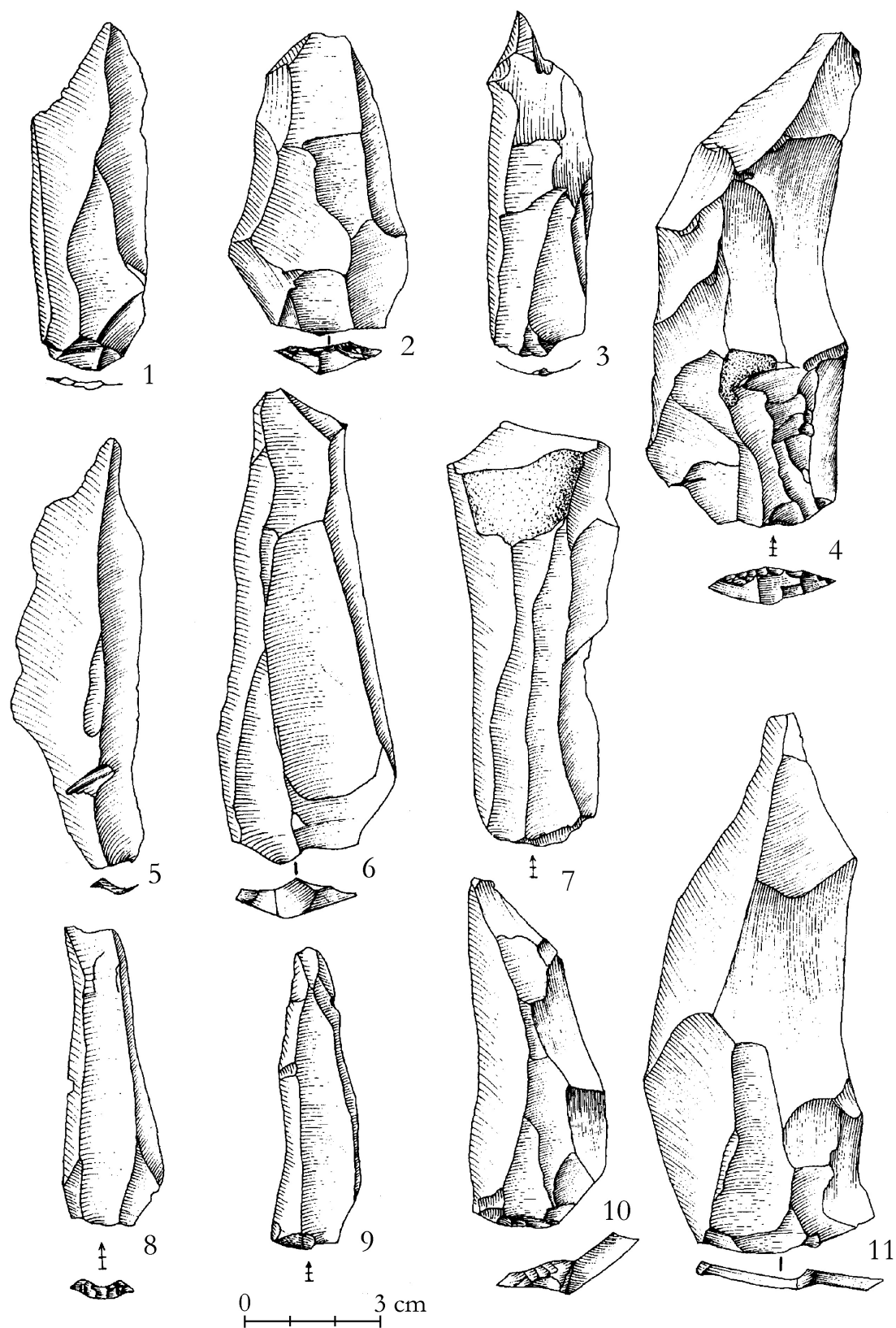


Figure 6.9. Taramsan blades from Taramsa 1.



Figure 6.10. Proximal view on refitted blades on a core of the Taramsan.

of the Sodmein Cave, no stratified sites have been located along the Red Sea in Sudan or in Egypt.

It is important to observe that most of the remains that are found in the Eastern Desert can be attributed to the Middle Palaeolithic, which at Sodmein Cave is clearly related to the Last Interglacial, suggesting that this period could have furnished enough subsistence possibilities for humans (Van Peer *et al.* 1996; Vermeersch submitted). However, the absence of correlation between the archaeological data of Sodmein Cave and bones of modern humans does not allow us to make any assessment of the Red Sea corridor during the Interglacial. But this problem applies for the whole Arabian peninsula and northern Africa.

Many authors argue that the cultural manifestations of humans are more advanced in Africa than in the rest of the world. Mellars (2006) suggests that, from 80 to 60 ka BP, in southern and eastern Africa there was a major increase in the complexity of the technological, economic, social, and cognitive behaviour of certain African groups. But d'Errico *et al.* (2003) do not accept dramatic differences in the cognitive abilities between the African modern humans and the Neanderthals. Cultural characterisation of modern behaviour is apparently very difficult and there is certainly no agreement between the authors.

In Egypt, in the Nile Valley as well as in the Eastern and Western Desert, an important human population is present during MIS 5. During the following periods the population seems to be gradually reduced (Vermeersch 2006). From MIS 4 on, population disappears from the



Figure 6.11. The child in its burial position at Taramsa 1.

Western Desert (Wendorf *et al.* 1993), apparently even from the large oases such as Dakhleh (Hawkins and Kleindienst 2002) and Kharga. According to Ambrose (1998), the archaeological record of the last glacial period in northern Africa shows very low population densities. He stresses that if the volcanic winter due to the eruption of the Toba volcano had an important impact on the African population, then modern humans may have differentiated. Most researchers from the genetic approach (Mitochondrial DNA and Y-chromosome DNA) are convinced that the way out was mainly or even exclusively the Bab el Mandab. There are some few archaeological data that seem to suggest some connection between the Horn of Africa and the Arabian peninsula (Rose 2004; McClure 2007). However, very few stratified sites belonging to the Middle and Upper Palaeolithic have been located in the Arabian peninsula and no dating is available. In the cultural material no connections with the Levant are apparent.

Another hypothesised route Out of Africa could have followed the Nile Valley. According to Van Peer (1998) there is indeed a clear connection between the Middle Stone Age of Eastern Africa, where anatomical modern man has its origin, and the Egyptian Middle Palaeolithic. However, according to Rose (2004), Site One in the Eastern Desert of Sudan is the most northerly site that witnesses contact with the East African Stone Age, excluding the existence of a northern route out of Africa. Still, anatomical modern man was already present in the Egyptian Nile Valley from around 60 ka BP (Vermeersch *et al.* 1998). If modern humans left North-East Africa through the Sinai, the cultural material of the lower Nile Valley and that of the Levant should attest some connections. This has not yet been identified. A methodological problem arises when comparing assemblages of both regions: In the Egyptian Nile Valley mainly extraction sites are known, whereas in the Levant the sites are more often living sites. Moreover, the understanding of the cultural similarities between Egypt and

South-West Asia is hampered by a problem of different research approaches (Vermeersch 2001).

There is no doubt that favourable environmental conditions are an important prerequisite for surviving along the suggested routes “Out of Africa”. Climatic conditions during the late Pleistocene are characterized by important oscillations. If the “Out of Africa 2” happened later than 70 ka BP, as accepted by most authors, the climatic conditions and their geomorphologic consequences seem not to be in favour of a migration through desertic areas, comprising the Sahara as well the Arabian desert. No traces of human occupation have been registered in the Egyptian Western Desert between MIS 5 and the Holocene. The Egyptian Red Sea coast was apparently also not the ideal area to occupy (Van Peer *et al.* 1996; Mercier *et al.* 1999). In southern Arabia, the magnitude of hyperaridity at the last glacial maximum is marked by a widespread phase of significant aeolian accumulation across all of Arabia. (Parker and Rose 2007). How could early modern humans move through the area under extreme dry conditions? Still, most DNA specialists put the “Out of Africa” straight through very arid regions. Most of the suggested routes seem to be impracticable during the dry periods of the Late Pleistocene.

Only Field and Lahr (2005) suggest that the route partly followed the Nile Valley. The Nile Valley was an ecological area isolated by deserts after about 70 ka BP until around 11.5 ka BP. Our knowledge of the Nile Valley environments is still very restricted. The Nile apparently behaved during the dry periods as a braided intermittent river (Paulissen and Vermeersch 1989; Wendorf and Schild 1989) with enough environmental possibilities for a sustained occupation.

The study of the Late Palaeolithic site Abadiya 3, Upper Egypt, generated new understanding of the geomorphology of the Nile Valley during cold glacial phases (Vermeersch

et al. 2006). During such cold periods, the water supply of the Nile was very restricted as can be deduced from the fact that the Blue Nile was not any more fed by the Lake Tana (Lamb *et al.* 2007) nor the White Nile by the Lake Victoria (Williams *et al.* 2006). The Egyptian Nile discharge is then extremely reduced whereas the extension of Saharan dunes into the Nile Valley was important. Those processes could have resulted in damming of the Nile Valley in Upper Egypt (Vermeersch *et al.* 2006). Such an aeolian dam was probably build up at Nag’Hammadi (Fig. 6.12) and at Armant (Upper Egypt). Behind such an aeolian dam, a lake developed, which was used for fishing by the Late Palaeolithic population of the Nile Valley (Wendorf and Schild 1989; Van Neer *et al.* 2000). A series of twenty-five radiocarbon dates from the highest Late Pleistocene deposits in Upper Egypt calibrates very clearly with the early Bølling period. Such an observation can be understood when we presume that, at the end of the LGM, the damming dune field was at its highest level. Lake Tana and Lake Victoria started to overflow, feeding respectively the Blue and the White Nile, from around 12.5 ka BP. This resulted in high discharges of the river Nile in Upper Egypt, causing very high lake levels behind the Nag’Hammadi dam until the discharge was able to breach the damming dunes (Fig. 6.13). Once the damming dunes were breached and with higher discharges, the Nile was deeply incised in the floodplain deposits and was able to erode most of the damming dunes. Several ^{14}C dates correspond to the dry cold period preceding the warming up period of the Bølling. Dates continue to be present in the first part of the Bølling, but come then to an abrupt end because dam breaching was probably a catastrophic event. Moreover, the higher discharge of the Nile caused an important narrowing of the floodplain.

Dam failure was a catastrophic event killing nearly the

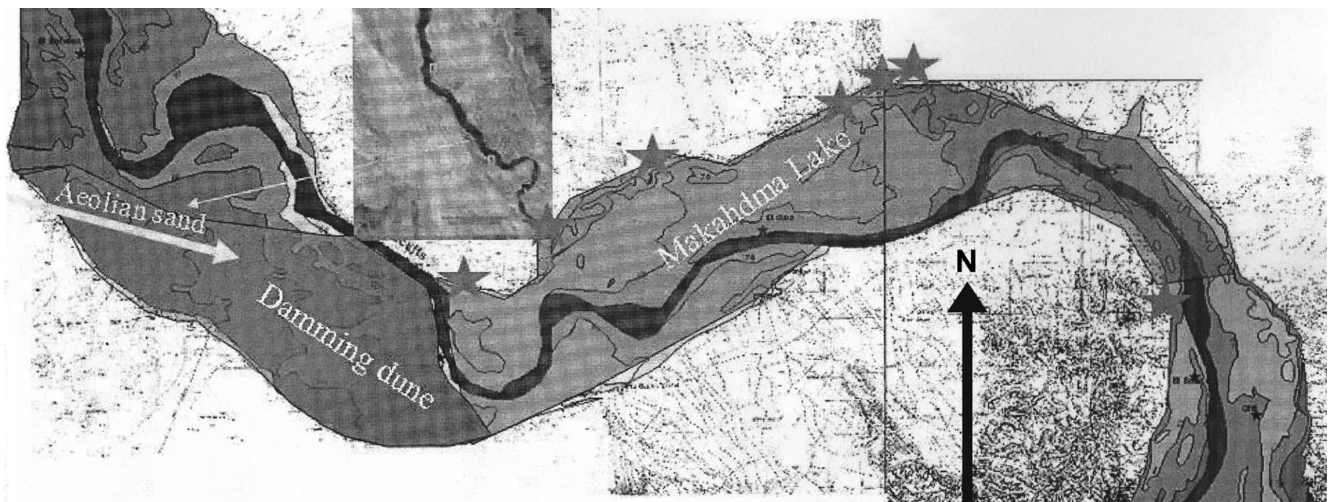


Figure 6.12. Damming of the Nile valley during the Late Glacial Maximum with dune near Nag’Hammadi and the Makhadma Lake upstream.

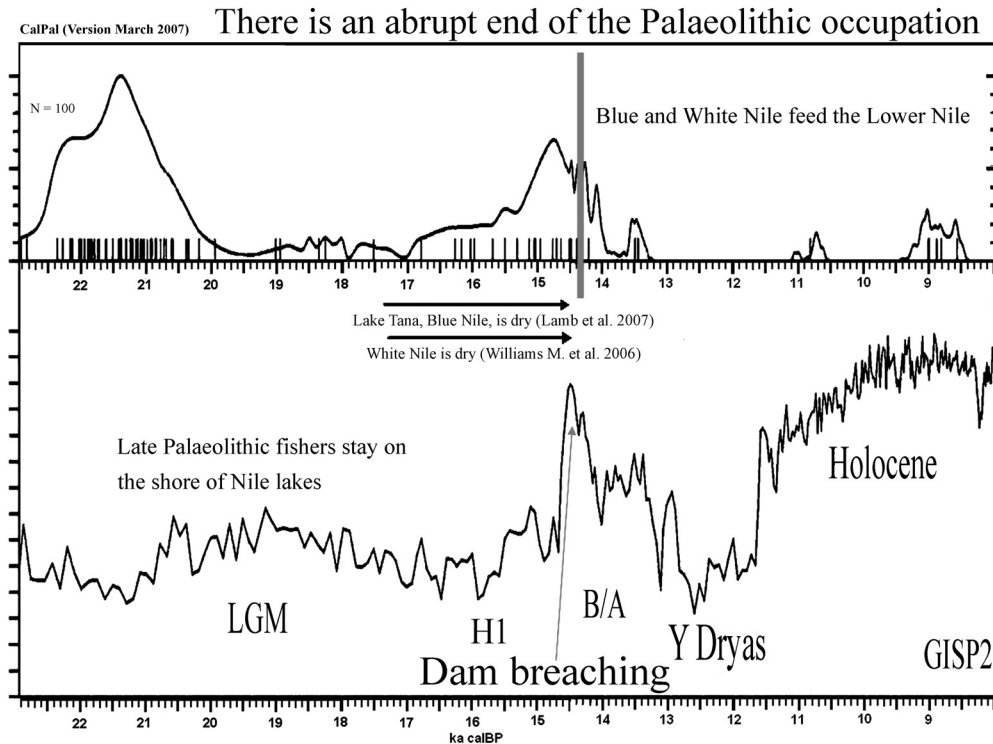


Figure 6.13. The correlation between the number of ^{14}C dates (upper part) and the GISP2 curve (lower part) after CalPal.

whole Late Palaeolithic population of the Egyptian Nile Valley. After the dam failure, the Nile eroded strongly and food was not any more available, resulting in violent deaths such as those identified in the burials at Jebel Sahaba (Wendorf 1968). There seems to be an absence of human population in the Egyptian Nile Valley from the aftermath of the catastrophic dam failure until around 8000 BP, when the Elkabian (Vermeersch 1978) appears. However, new groups of humans are populating the Eastern Desert from about 9500 BP (Kuper and Kröpelin 2006). Are they coming from the Sahel, from the Sudanese Nile Valley, from Cyrenaica, from the Saharan mountains, from the Negev? No data are yet available. Only much later, after 6300 BP, the Nile Valley population is rapidly expanding. This population has introduced sheep from both the Eastern and the Western Egyptian Desert and agriculture from the Levant (Vermeersch 2008). It is not yet clear which part of the population came from the Sahara and which from the Levant.

The present-day population of the Nile Valley can thus not be used for DNA analyses because that population is probably not related to the Late Pleistocene population of that area. According to Olivieri *et al.* (2006) the Upper Palaeolithic humans obtained the mtDNA legacy of the Levantine Early Upper Palaeolithic, which moved into the Nile Valley *c.* 24,000±5700 BP. Such a movement can eventually be understood if one accepts that the Shuwikhatian

can indeed be a successor of the Ahmarian, which is clearly present in the Lagaman.

For the time being it is difficult to conclude which route has been followed by anatomical modern humans in their way “Out of Africa”. Was it the Nile Valley or the Bab El Mandab? We are presently missing too much data to reconstruct that way “Out of Africa”. The DNA research seems not in a good position to answer all the aspects of the “Out of Africa 2”. Still, anatomical modern humans are present in the Egyptian Nile Valley at Taramsa 1 at an early time.

Upper Palaeolithic

Very few information related to the Upper Palaeolithic in Egypt is available. The Western and Eastern Deserts are avoided by humans and only a few sites from the Upper Egyptian Nile Valley have disclosed some information. Some sites lacking stratigraphic and chronologic data, such as El Tiwayrat (Fig. 6.1), are characterised by a blade production (Fig. 6.14) which could be much older than the Upper Palaeolithic (Vermeersch *et al.* 2005). It seems that the Upper Palaeolithic occupation of the Egyptian Nile Valley (Wendorf and Schild 1976; Vermeersch *et al.* 2000c, 2002a) was very restricted (Vermeersch 2006). It occurs at 40–32 ka BP (Khaterian) and 25–24 ka BP (Shuwikhatian).

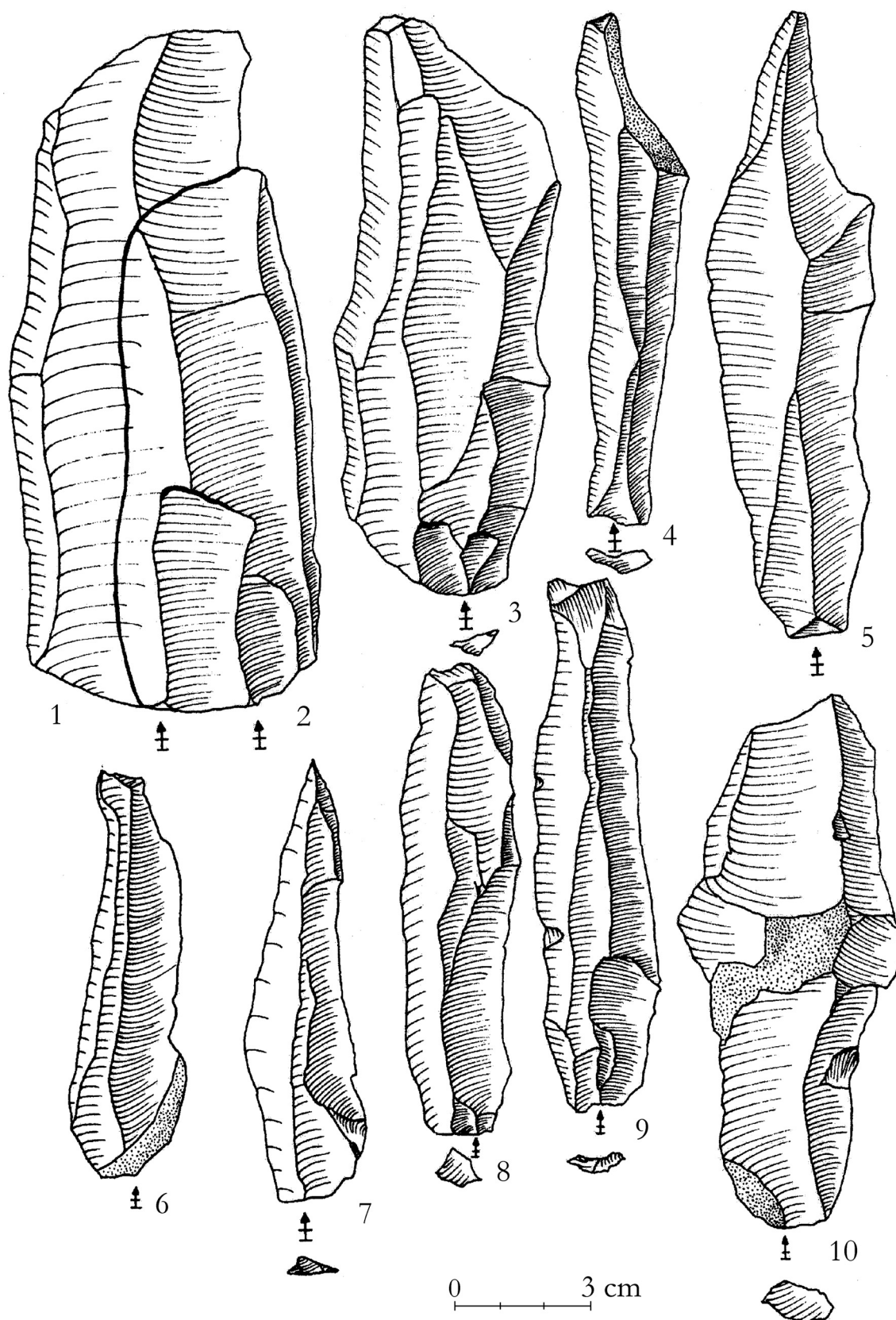


Figure 6.14. Blades from the El Tiwayrat site.



Figure 6.15. The site of Nazlet Khater 4 with the presence of a bell pit at each arrow.



Figure 6.16. A person emerging from an underground gallery into a bell pit.

Khaterian

The Khaterian (40 to 35 ka ago) from Nazlet Khater 4 (Fig. 6.1) is a fully Upper Palaeolithic industry. Nazlet Khater 4 is an underground flint extraction mine with bell pits and subterranean galleries, intentionally shaped to obtain a better exploitation possibility, representing a totally new extraction strategy (Fig. 6.15). The basement of the Nazlet Khater 4 site consists of greenish silts and fine sands covered by about 1.0 m of Nile deposits, composed of well-rounded gravels with flint cobbles and of consolidated brown granular silts. Local limestone gravels in turn cover these Nile deposits. Several types of digging activities are present. In addition to ditches, similar to those of Nazlet Safaha, vertical shafts were dug down to a depth of 2 m through the covering deposits and ending on top of the greenish silts. Sometimes they were enlarged at their bases to form *bell pits*. Underground galleries extended from the ditch walls or from the bottom of the bell pits. In these galleries, the gravels were exploited horizontally for several metres. The largest galleries (Fig. 6.16) explored extend for more than 10 m². They display often subterranean connexions. Gallery roofs have sometimes collapsed. On the walls of shafts and galleries, cutting marks from the horn picks used in gravel extraction are observed. Hartebeest and gazelle horns together with bifacial axes have been used in the extraction. Rough extraction activities were also performed by heavy hammers. The mining resulted in a complete exhaustion of the channel lag cobbles throughout their extent of about 800 m². Hearths *in situ* and charcoal blown into the ditches, bell pits and galleries gave ample dating opportunities. There is no doubt that the Upper Palaeolithic humans at Nazlet Khater 4 had a good practical knowledge of the geological structure of the area. They predicted where a shaft could be

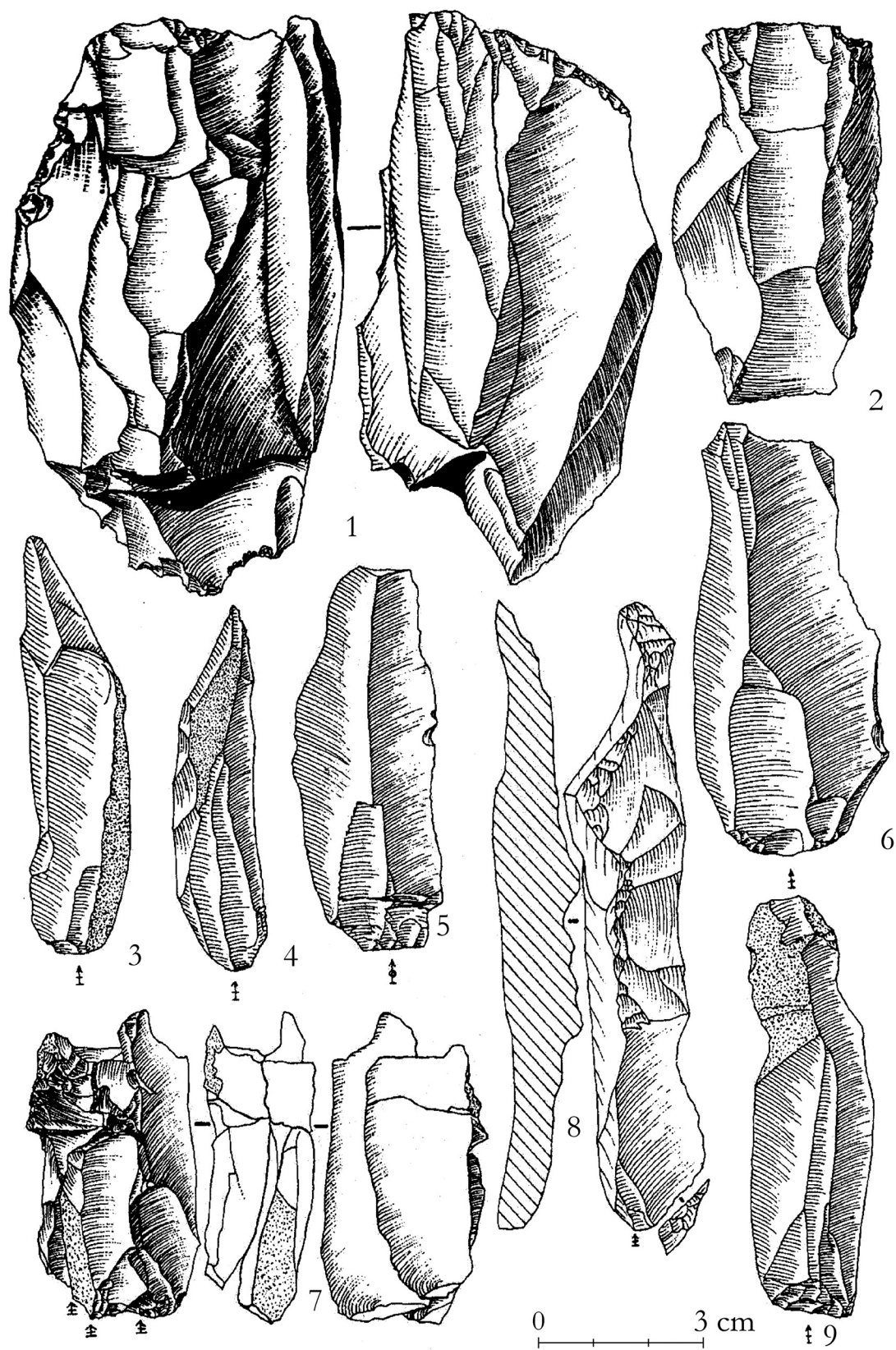


Figure 6.17. Cores and blades from Nazlet Khater 4.

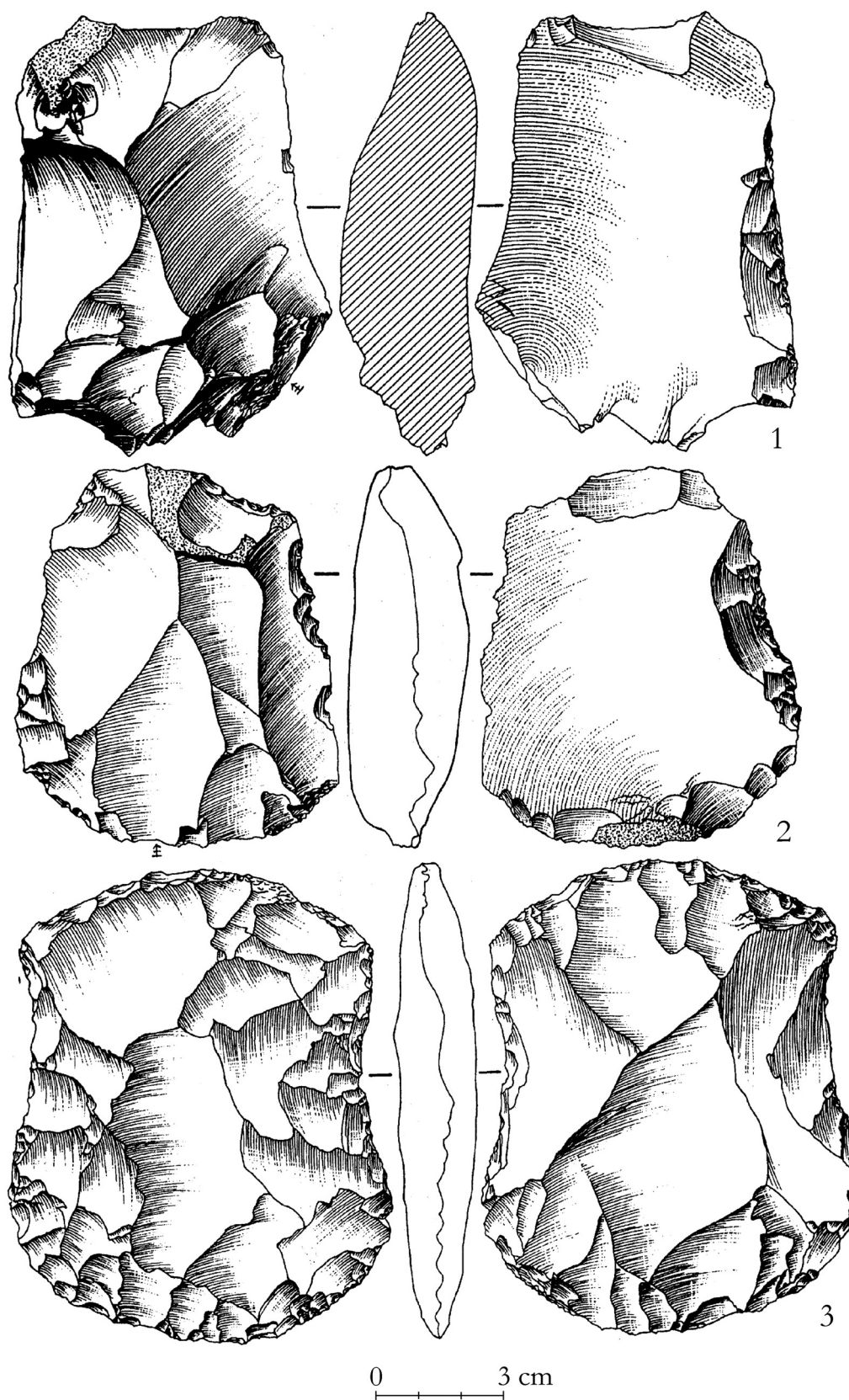


Figure 6.18. Axes from Nazlet Khater 4.



Figure 6.19. The boulders on the Nazlet Khater 2 hill (suggesting the presence of a burial place?).



Figure 6.20. The burial 2 at Nazlet Khater.

taken down for reaching the flint cobble layer they were looking for.

Debitage techniques are oriented to blade production and are fully Upper Palaeolithic (Fig. 6.17). No Levallois or Halfan technology is present. The best represented core type is the single platform core without traces of preform shaping. Opposed platform cores exist. Tool shaping was clearly not an on-site preoccupation, although some burins and endscrapers are present. Some flat bifacial axes (Fig. 6.18) were collected similar to the one found in the nearby burial 2. The blade assemblage from the site of Nazlet Khater 4 and the use of bifacial axes evoke some Taramsan features (Vermeersch *et al.* 2002).

The Nazlet Khater 4 site is associated with burials on the nearby with large boulders covered hill (Fig. 6.19) of Nazlet Khater 2 (Vermeersch 2002b; Crevecoeur 2008), which gives the hill a rather exceptional morphology, being the only such one in the wide environment. Maybe the Upper Palaeolithic people were attracted by such morphology, giving a special identity to their burials. We only found two burials but those have been found by chance. I am convinced that with an intensive survey other Upper Palaeolithic burials could be found on the hill. Burial 2 (Fig. 6.20) had a body, oriented NW–SE, laid on its back in a contracted position, legs joined together, but upright. Arms were flexed towards the skull. At the left of the upper limb, bones from a foetus have been recovered. Nearby to the south an ostrich eggshell fragment was found together with charcoal fragments, dated at 37,570±350–310 BP (GrA-20145). South of the ribs, a fragment of burnt earth was found. The skull was missing. Burial 2 consisted of a desiccation crack in the silty clay that apparently existed at the time of the interment. The crack was slightly adapted and the body has been laid down

in that crack. The body was inhumed, lying at full length on its back. The head, which was slightly turned to the left, pointed towards the west and the legs were in an aslant, rising position. The right arm had been stretched along the body, while the left one was folded so that the hand rested upon the lower part of the pelvis. A bifacial axe, similar to those from Nazlet Khater 4, had been carefully laid upon the bottom of the grave, at the right of and next to the skull. It is clearly a grave good.

NK 2 man

The Nazlet Khater 2 skeleton from burial 2 belongs to an anatomically modern human who exhibits a very robust skull with some archaic features, notably on the mandible (Thoma 1984; Pinhasi and Semal 2000; Crevecoeur and Trinkaus 2004; Crevecoeur 2008). Nazlet Khater 2 possess unusually wide mandibular rami, an archaic feature in which they are approached by only one OIS 2 specimen (Oase 1) and two OIS 3 specimens (Dar-es-Soltane 5 and Pataud 1) and in which it recalls several Middle Pleistocene European and African specimens (Arago 2, KNM-BK 67, Loyangalani 1, Mauer 1 and Tighenif 3). The Nazlet Khater 2 mandible is exceptional among early modern humans for the robustness of its mandibular corpus, both anteriorly and laterally, and this is probably most responsible for its alignment with the Neanderthals in the multivariate analyses of mandibular metrics. Yet, its molar dimensions are most similar to those of early modern humans (plus the Aterian Dar-es-Soltane 5

and Témara 1). Its right malleus (Crevecoeur and Trinkaus 2004) cannot be distinguished metrically or morphologically from an extant human sample. However, it shares with most of the fossil specimens a relatively extended manubrium angle, which falls in the upper part of the modern human range of variation. The dimensions of the face of NK 2 places him in company of the archaic *Homo sapiens* and of the modern middle Palaeolithic representatives characterised by a more important facial height and breadth than all other modern specimens. The combination of derived modern human and retained archaic features in the Nazlet Khater 2 skeleton has been pointed out by the comparative study of its molar and mandibular morphology (Crevecoeur and Trinkaus 2004; Crevecoeur 2008).

The association of this individual with the mining site of Nazlet Khater 4 (NK 4) provides a unique opportunity to understand the arthritis and enthesopathy lesions of this individual within a well defined archaeological context. After elimination of the most frequent causes of enthesopathy and osteoarthritis, it appears that the many lesions seen on NK 2 are evidence of an arduous life style during which this individual was submitted to heavy mechanical stresses (Crevecoeur and Villotte 2006). Its geographical and chronological position makes it NK 2 one of the oldest MIS 3 modern human skeletons in northern Africa (Fig. 6.21). The lack of modern human remains at the beginning of the Upper Palaeolithic limits our knowledge of variation in early *Homo sapiens* during this time.

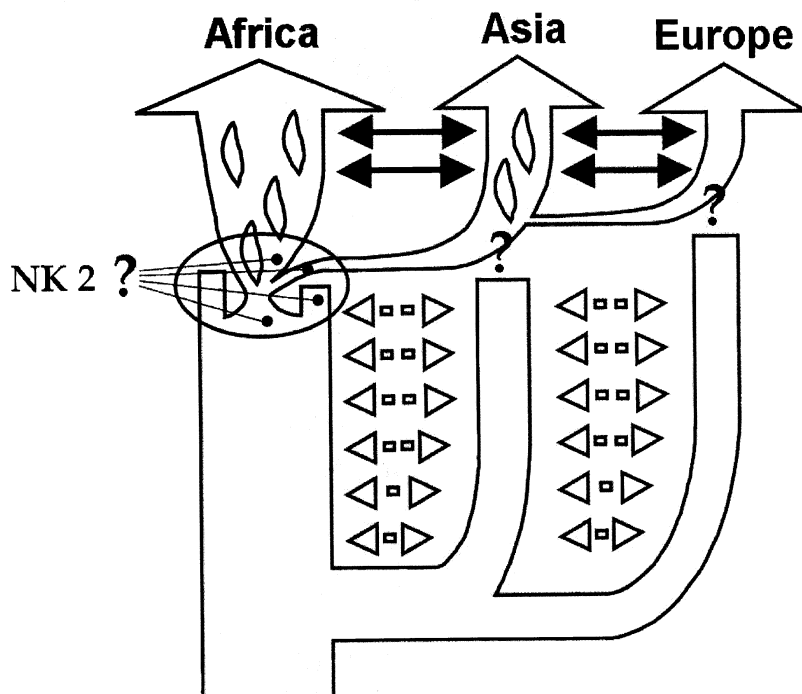


Figure 6.21. Hypothesis on the origin of modern man with the position of NK 2, modified from Excoffier (2002) and Crevecoeur (2008).

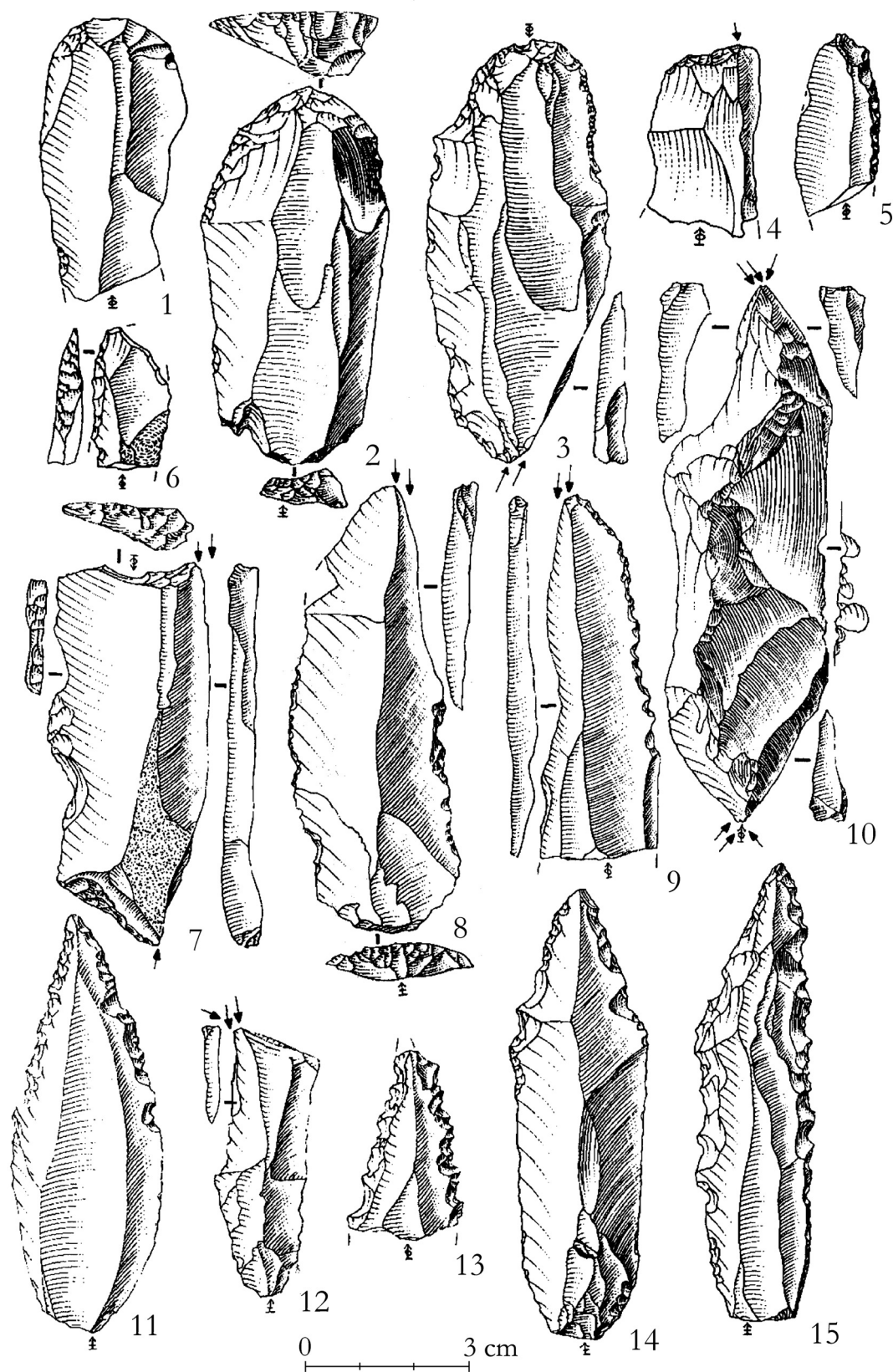


Figure 6.22. Tools on blades from Shuwikhat 1.

Shuwikhatian

Next in age during the Upper Palaeolithic, around 25 ka BP, is the Shuwikhatian (Vermeersch *et al.* 2000c) in Upper Egypt (Fig. 6.1). The flaking process is organised from opposed platform cores. Crest preparation is always applied. The production of robust blades is one of the characteristics of the assemblage. Nearly all tools are made on a blade (Fig. 6.22). Finely denticulated blades are the most common tools. Burins and end-scrapers on strong blades are numerous. Borers and truncated pieces are rare. Backed bladelets, Ouchtata bladelets and bifacial pieces are absent. The sites, not numerous, are small campsites where the faunal remains are characterised by aurochs, hartebeest, dorcas gazelle and catfish. As the preservation conditions at the sites are poor, the dominance of large herbivores must be considered as a result of differential preservation. We presume that, as the sites are situated nearby the edge of the floodplain, fishing was certainly a very important activity. Collecting tubers and other plants provided also important elements of the diet. Unfortunately, bad preservation did not allow a better understanding of the living conditions of the inhabitants of the Shuwikhatian sites.

The Upper Palaeolithic is totally absent from the desertic regions of Northeast Africa and very much restricted in the Nile Valley. With the end of MIS 4, there is clearly an important reduction of the human population in the Nile Valley.

Late Palaeolithic

The Late Palaeolithic however is quite well-represented by an important number of sites, which are uniquely found along the Nile in Upper Egypt. The population of the Nile Valley was certainly growing and with time cultural changes occurred. Several groups, such as the Fakhurian, the Kubbanian (Fig. 6.1), the Idfuan, the Ballanan-Silsilian, the Afian, the Isnan and the Qadan have been identified and described by Wendorf and Schild (1989) who give a critical review of this period (cf. also Chapter 7). The Late Palaeolithic groups are present in Upper Egypt from about 22 ka until about 12.5 ka BP. They are small hunting-gathering-fishing groups living mainly from what the Nile Valley is providing. The significance of the Sebilian remains problematic. The desert remains apparently without any human population (Kuper and Kröpelin 2006). After 12.5 ka BP, the Nile Valley seems deserted, whereas from about 9500 BP, there is a growing population in the Western Desert and somewhat later also in the Eastern Desert. When the agriculture is introduced in the Nile Valley, an important population increase is registered, leading rapidly to important societal changes.

Conclusion

In Egypt, the remains of the Middle and Upper Palaeolithic populations are very restricted due to the changing climate of the desert and also because of the sedimentation history of the Nile Valley. The abundance of good quality flint in local and Nilotic deposits in the valley gave the possibilities of large-scale exploitation of the flint sources. Many sites attest the presence of intensive collecting activities by Middle Palaeolithic groups. Most important however is the presence of numerous sites where systematic quarrying activities left specific extraction structures: pits, trenches, vertical shaft, and subterranean galleries. The oldest traces of such structures are late Middle Pleistocene (Taramsa 8), but most are from the (late) MIS 5 (Nazlet Khater 1, Beit Allam, Nazlet Safaha) or later (Taramsa). Subterranean activity is more than 35,000 years old. Systematic blade production is generated in the Taramsan.

Burials from the Taramsan and from the Khaterian have been found. They attest real burial practices in the Nile Valley from the Middle/Upper Palaeolithic transition phase and from the early Upper Palaeolithic.

Note

- 1 I use the term “flint” also for what some authors designate as “chert”.

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Late Palaeolithic Hunter-Gatherers in the Nile Valley of Nubia and Upper Egypt

Romuald Schild and Fred Wendorf

A bit of history

The valley of the main Nile river has not been the subject of a rich and long history of Quaternary and Palaeolithic studies, despite being an immensely important river in human history. Pharaonic studies, Ancient Egypt and pre-Quaternary geology have attracted almost all of the interest of researchers. Occasional papers on Palaeolithic archaeology were published in the late 19th century; however, it was G. Schweinfurth (1901, 1904) who began detailed Quaternary studies and reported Stone Age artefacts in their sedimentary context for the first time. In the 1920s and 1930s, E. Vignard (*e.g.*, 1921, 1923, 1934) collected final Late Palaeolithic sites from silt and dune surfaces near Kom Ombo, and K. Sandford and W. Arkell (Sandford and Arkell 1933; Sandford 1934; see also Huzayyin 1941) studied Nile *terraces* with associated lithics in a huge valley stretch extending from Nubia to Fayum.

In the 1960s, modern interest in Palaeolithic studies and associated Nilotic sediments began with the Nubia Salvage Campaign (Fig. 7.1). It was the Combined Prehistoric Expedition that researched Late Palaeolithic sites in Nubia, between the First and the Second Cataracts, in Egypt and Sudan (Wendorf 1968a). Two other groups carried out the work in prehistory and Quaternary geomorphology in Nubia. In the Kom Ombo plain, a joint Yale University-Canadian National Museum team worked along the eastern bank of the river, around 35 to 55 km downstream from Aswan (Reed 1966; Smith 1966; Butzer and Hansen 1968; Phillips and Butzer 1973). On the other hand, a research group assembled within the University of Colorado Expedition concentrated its investigations in a small area opposite Wadi Halfa (Irwin *et al.* 1968).

After the Nubia Campaign, the Combined Prehistoric Expedition transferred its activity to Upper Egypt, first to the Edfu (Idfu), Esna (Isna), Makhatma (Makhadma), and Dishna areas (Wendorf and Schild 1976), and later to Wadi Kubbaniya, just north of Aswan (Wendorf *et al.* 1980, 1986,

1989, 1990), and then again to the Deir el Fakhuri area, north of Esna (Wendorf *et al.* 1997).

A very important contribution to the prehistory and Quaternary geomorphology of the main Nile Valley has been made by a Belgian group associated with the Catholic University of Leuven. At the beginning, in the late 60s and early 70s, P. M. Vermeersch (see Chapter 6) had excavated a Holocene site at El Kab at mid-distance between Aswan and Luxor (Vermeersch 1978). A few years later, in 1976, a research team named the Belgian Middle Egypt Prehistoric Project of Leuven University, lead by Vermeersch, began exploration of Early to Late Palaeolithic sites between Luxor and Asyut. The work extended from 1976 to the mid-1990s (Vermeersch *et al.* 1982, 1990, 2006; Vermeersch 1986, 2000, 2002; Mazhar *et al.* 2004; Mazher *et al.* 2005).

Environment

Modern Nile

The Nile is an unusual river. It flows for thousands of kilometres in a single, often twisting channel, cut into a deep structural valley. Almost all of its waters derive from three tributaries, the White Nile, the Blue Nile and the Atbara. Of these the most important is the Blue Nile, which drains the central and northern highlands of Ethiopia and contributes almost twice as much water as the White Nile, which is fed by rainfall from the Equatorial Lake Plateau. The Atbara, which drains the northern highlands of Ethiopia, contributes the least water (Hurst and Phillips 1931; Woodward *et al.* 2007).

The Blue Nile and the Atbara supply almost all of the silt particles suspended in the water, especially during the period of the maximum flood in August and September (Badri 1972). These particles settle over the bottom of the inundated land surfaces, building up silt beds. Since the amount of water in the river is controlled by the rainfall periods in Ethiopia and Uganda, the main Nile is also a

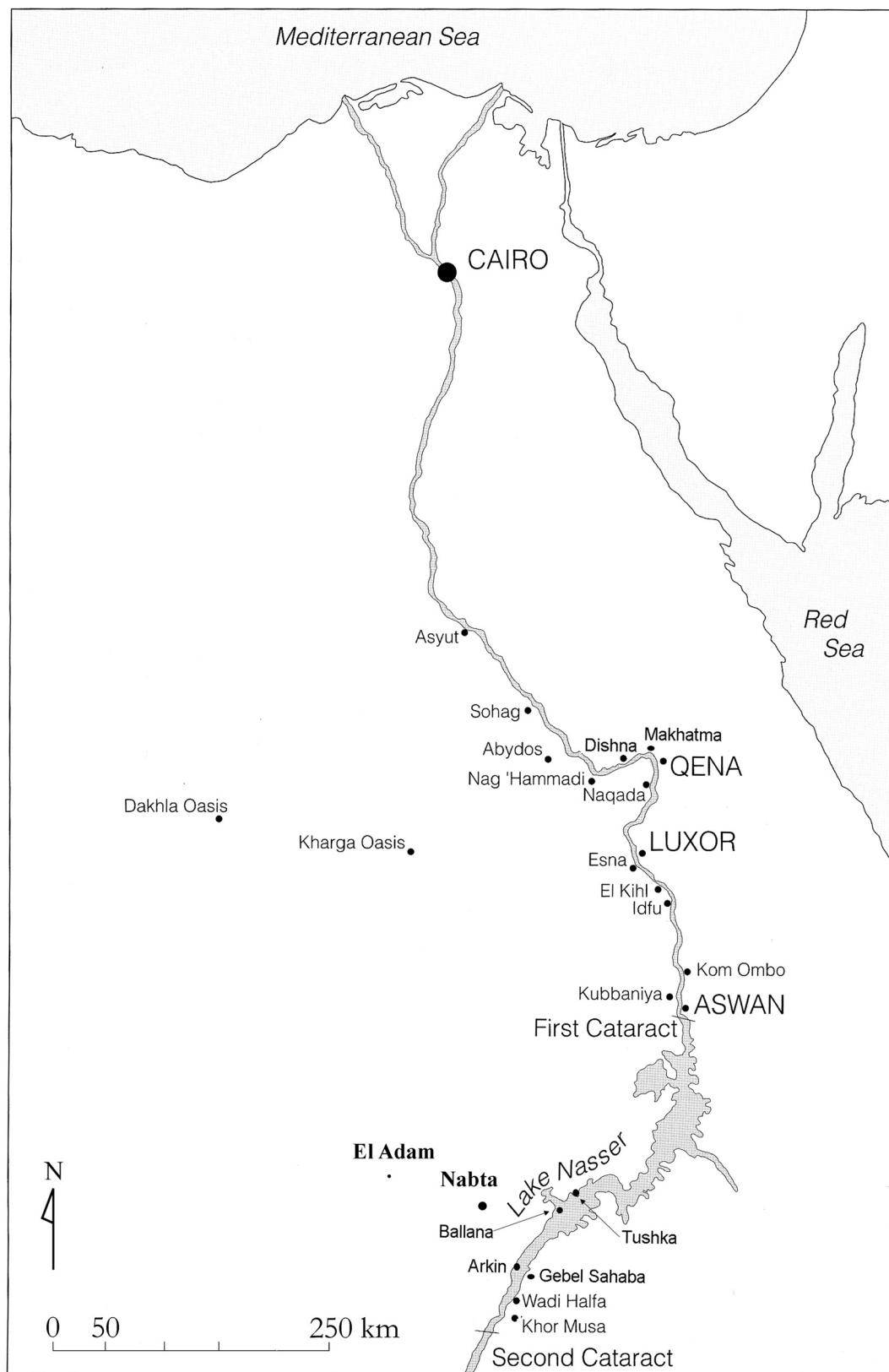


Figure 7.1. Most important areas of Late Palaeolithic occurrences in Lower Nubia and Upper Egypt.

highly seasonal river. Before the construction of the first Aswan Dam, in 1902, the late summer floods at Wadi Halfa in Sudanese Nubia, averaged 6.5 m above the lowest level of the river in March (Ball 1952, 5).

Late Pleistocene Nile

Today, particularly after the Nubia Salvage Campaign and the work of the Combined Prehistoric Expedition, the Belgian Group, the Yale-Canadian Group, and the University of Colorado team, a large amount of data are available on the Late Pleistocene geomorphology and prehistoric archaeology of the main Nile (*e.g.*, Butzer and Hansen 1968; de Heinzelin 1968; Wendorf and Schild 1976, 1989a; Wendorf *et al.* 1980, 1986, 1989, 1990, 1997; Williams and Adamson 1980; Said 1981, 1993; Paulissen and Vermeersch 1987, 1989; Schild and Wendorf 1989; Vermeersch 2000; Vermeersch *et al.* 2006).

Dating the Late Pleistocene Nile deposits

Was the Late Pleistocene Nile in Egypt and Nubia similar to the river of today, and if so, to what extent? In many respects it was, exhibiting confinement to a relatively narrow belt within the entire valley, a regimen of deposition, and mineral composition of the sediments largely similar to the Nile of yesteryear. However, the work in Nubia in the 1960s produced unexpected information. It appeared that the Late Pleistocene Nile had literally no terraces. Instead, the rising (aggrading) river bed, a result of high-amplitude seasonal floods overloaded with sediments, created variable, slightly rolling landscapes dotted with seasonal pools, rises and banks built of silt and sand beds, often repeating the pre-existing morphology. In the Late Pleistocene there were two major periods of aggradation or alluviation (Schild 1987), with a rising river bed and silt accumulation at constantly higher levels: the Late Middle Palaeolithic Alluviation (LMPA) and the Late Palaeolithic Alluviation (LPA). They had been preceded by a major lowering of the Nile bed, or down-cutting, of Middle Palaeolithic age and, in turn, were separated by another incision of the river in the Upper Palaeolithic. During this down-cutting, the river bed certainly reached a level below that of the modern Nile. A later incision followed the Late Palaeolithic Alluviation, and in the final stage of the Late Palaeolithic, the river aggraded again for a short time during the Arkinian Alluviation (AA), immediately preceding the down-cutting of the Holocene period. The Late Middle Palaeolithic Alluviation (LMPA) reached about 30 m above the modern floodplain in Nubia, between the Second and the First Cataracts and about 20 m above the modern floodplain in Lower Nubia, just north of the First Cataract. In northern Upper Egypt, the deposits of this age submerged under the modern river. The Late Palaeolithic Alluviation, between the Second and the First Cataracts, reached a level of about 28 m above the modern floodplain, while just north of the First Cataract its deposits

are seen at the same maximal level above the floodplain. In Upper Egypt, however, west of Qena, the silts and clays of the LPA occur no higher than at about 6 m above the floodplain. The deposits of this sedimentary unit have not been recorded in Middle Egypt.

Dating of these major episodes in the Late Pleistocene sedimentary history of the river is not resolved precisely, a result of relatively scarce radiometric dating of most of the depositional episodes along the main Nile and elsewhere. The Late Middle Palaeolithic Khormusan sites buried in the silts and riverine sands of the Late Middle Palaeolithic Alluviation are certainly older than 41.5 ka BP (Wendorf *et al.* 1979). The TL dates obtained for dune sands associated with an upper section of this alluviation indicate ages of around 50 ka BP (Schild and Wendorf 1989, 49). On the other hand, the TL assays on dune sands just above the earliest Nilotic silts of the LMPA recorded in the mouth of Wadi Kubaniya are around 60 ka old (Schild and Wendorf 1989, 49), indicating that the beginning of this alluviation falls at around 70 ka ago. In short, the LMPA is basically coeval with the late, clearly cold, phase of MIS 4 (Andersen *et al.* 2006).

There are no alluvial deposits or archaeological sites in the Nile Valley that are directly associated with the period of incision separating the two major Late Pleistocene aggradations of the river bed, which is probably roughly contemporary with numerous warmer oscillations during the late MIS 3. The Upper Palaeolithic materials of the Nazlet Khater 4 flint quarries in the lower desert of Middle Egypt (Vermeersch *et al.* 1982) are most probably associated with a later phase of this down-cutting.

The earliest age estimates related to human occupations buried in the LPA alluvial deposits (Shuwikhatian) date around 25,000±2,500 TL years ago (Vermeersch *et al.* 2000d, 120) and 21 radiocarbon ka BP (Fakhurian), or just around 25.5–24.5 cal ka BP (Wendorf and Schild 1989a); however, it is very likely that the beginning of this aggradation is a few millennia older, as suggested by Site E6102, which is deeply buried below the modern floodplain in a wall of the Maghar canal, on the west bank, just opposite Makhatma (Wendorf and Schild 1976, 105). The site is embedded just below a brown clayey silt, probably similar to the Makhatma area, Shuwikhat silts of Paulissen and Vermeersch (1987, 47) at an elevation of only about 3 m above the present Nile (Wendorf and Schild 1976, 260). Its relatively meagre inventory is rich in Levallois pieces and retouched elements. It also contains a fully arch-backed piece, or segment. This section of time falls in a late, cold part of Greenland Stadial 3 (Rasmussen *et al.* 2008), at the time of the Last Glacial Maximum (LGM).

Around 21.5–20.5 cal ka BP, in the early Kubaniyan and Halfan, a deceleration in the deposition of fine, over-bank deposits of the Nile is marked by the development of dark blackish clays and silty clays in the interdunal lows in

Lower Nubia, at Ballana, Tushka (Albritton 1968), and Wadi Kubbaniya (Schild and Wendorf 1989, 92). These clays, identified as Upper Vertisols (de Heinzelin 1968, 49), are a result of *in situ* enrichment in clay particles of the silt deposits during the process of vertisol formation. The deceleration in silt deposition is seemingly synchronous with the termination of Greenland Interstadial 2 (GI-2), whose onset is dated at $23,340 \pm 298$ (Andersen *et al.* 2006, 3254) years ago (b2k), and/or the onset of Greenland Stadial 2 (GS-2c) at $22,900 \pm 573$ (b2k) (Lowe *et al.* 2008, 10). Uncertainties concerning the accurate ^{14}C half-life estimate make the exact calibration of these radiocarbon dates tentative (compare Chiu *et al.* 2007, 32).

Of the numerous radiocarbon measurements relating to the highest Nilotic deposits of the LPA and the beginning of the following incision, the most informative are those obtained from the *in situ* topmost sediments (Kubbaniya Dam Lake) of the final deposition of the aggradation, occurring just before the down-cutting and the drainage of the lake at the mouth of Wadi Kubbaniya. They fall around 12.4 ka BP, or 14.6–14.2 cal ka BP. The radiocarbon age for the drainage of the lake at Wadi Kubbaniya of about 14.5 cal ka BP (SMU-1032) suggests an early Greenland Interstadial GI-1e (Walker *et al.* 1999), or early Bølling age for the beginning of the down-cutting of the Nile ending the LPA. However, a number of radiocarbon ages for the Late Palaeolithic sites presumed to be associated with the highest floods of the Late Glacial Nile end around the Bølling/Older Dryas confine (GI-1e/1d). The beginning of Greenland Interstadial 1 is also contemporaneous with the age of the increased rainfall in Ethiopia and Equatorial Africa, a major transgression of Lake Albert (Beuning *et al.* 1997), the opening of the overflow at Lake Victoria (Livingstone 1980), leading to the formation of the modern discharge regime in the Nile basin (Woodward *et al.* 2007, 271), and the increased flood discharge in the Blue Nile (Adamson *et al.* 1982).

This important incision of the river, also termed Birbet (de Heinzelin 1968, 47), is thus largely coeval with the warming of Bølling and Allerød as shown by the radiocarbon age (if corrected for fractionation) of a late Isnan site (E71P5), north of Edfu, stratigraphically associated with the already incising Nile (Wendorf and Schild 1976, 40). It continues at least throughout the early Holocene, with a short pause during the Arkin aggradation, in the Younger Dryas, or Greenland Stadial 1 (GS-1), recorded at Arkin, in Lower Nubia, between the First and the Second Cataract (de Heinzelin 1968, 49).

River behaviour and climates

Dating of the Late Palaeolithic Alluviation of the main Nile places it in MIS 2, or more precisely, in the timespan extending from the Last Glacial Maximum, at around 28.5 cal ka BP until 24.5 cal ka BP (Clark and Mix 2002;

Svensson *et al.* 2006), to the beginning of Bølling and, thus, covering most of the last Pleniglacial of Europe. It is the time when the outside world, the Western and the Eastern Deserts, were hyper-arid and even the oases were dry (Wendorf *et al.* 1993). Life was confined to the river channel and its seasonally flooded narrow margins, separated from the high cliffs of the valley by the low desert. In the headwaters of the Blue Nile and the Atbara it was also dry, but cold. The rains were highly seasonal and slopes prone to erosion, a result of scarce vegetation. The White Nile almost ceased to flow (Williams and Williams 1980; Adamson 1982). Periglacial phenomena and grassless slopes aided erosion and led to the increased influx of mineral sediments in the rivers (Adamson *et al.* 1980; Williams and Adamson 1980; Hurni 1981; Woodward *et al.* 2007; compare also Krom *et al.* 2002, 73). The main Nile, as well as the Blue Nile and the Atbara, became highly seasonal and overloaded with sediments during rainy periods. This resulted in aggradation, or an increased deposition of sands and silts downstream from the headwaters. Water levels between the peak of the flood and the low water stage could have been much higher than in modern times. The main Nile became a highly braided river, almost dry during the low water season, with isolated larger pools of water, albeit a full bank river during the flood, leaving only a very narrow habitable margin of land between the low desert and the water. It was a landscape with no close analogy anywhere in the world (Fig. 7.2). Furthermore, a general lowering of temperatures in both hemispheres at the LGM suggests decreased yearly temperatures in the Nile Valley as well, a fact that has been supported by a somewhat cooler structure of mollusc assemblages buried in Nilotic deposits of that time (Gautier 1976, 352; Gautier and Van Neer 1989, 140). In the main Nile Valley, this cooling was most probably also reflected by lengthening of the winter period, as suggested by the number of circuli developing between the annuli in the pectoral fin spines of the catfish from Wadi Kubbaniya (Olsen 1980).

At the onset of the Late Glacial, during Greenland Interstadial 1, the increased rainfall in the headwaters, the lengthening of the discharge, and the reduction of the sediment load in the river brought about a major change in the regimen of the Nile. The Nile became a meandering river cutting into the older sediments and gradually lowering its bed (Schild and Wendorf 1997).

The landscape during the Late Palaeolithic Alluviation, along the western bank of the river in Lower Nubia and Upper Egypt, at Wadi Halfa west, Ballana, Tushka, Wadi Kubbaniya and north of Esna, was largely different than that of today, although various relics of a similar setting appear even today alongside the west bank of the Nile. It was a landscape dominated by fields of phytogenic dunes, deposited by westerly winds blowing from the Western Desert and forming light yellow plots of land within the

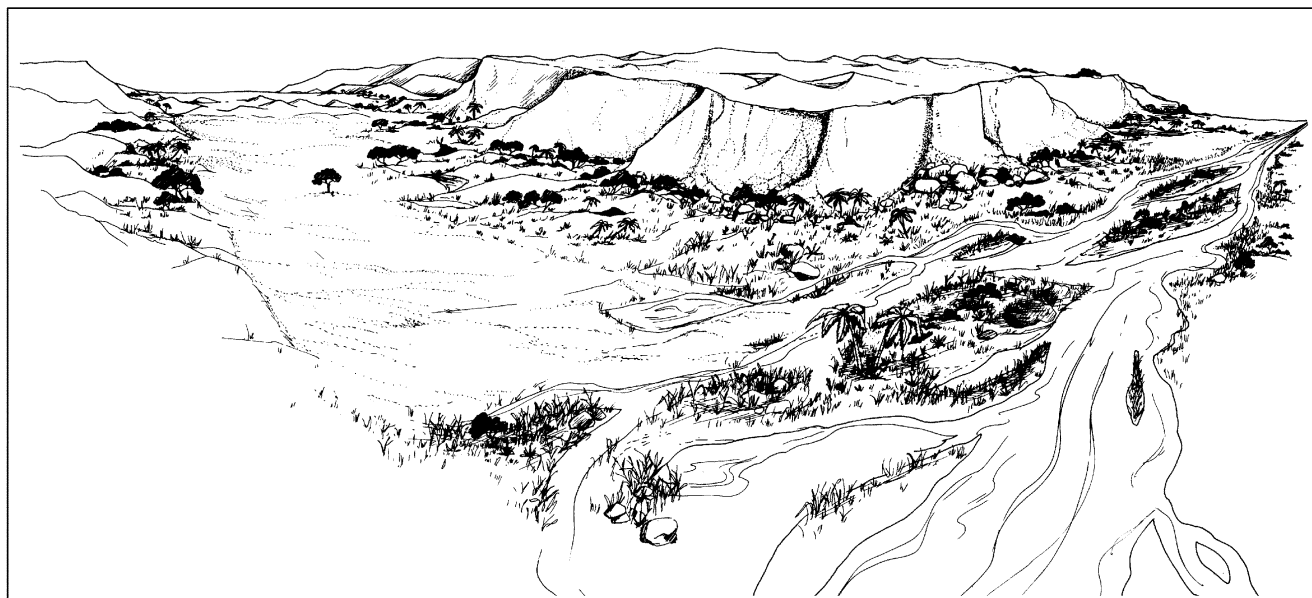


Figure 7.2. Braided Late Palaeolithic Nile at the mouth of Wadi Kubbaniya during the low water season.



Figure 7.3. Dammed lake at the mouth of Wadi Kubbaniya just before termination of the Late Palaeolithic Aggradation, low water stage, level of the dam lake exaggerated.

vegetation belt of the river. The dunes would be seasonally submerged during floods, while numerous perennial and seasonal interdunal pools and dammed lakes (Fig. 7.3), fed by seepage and the overflow of the Nile flood waters, dotted the scene, exposing abundant bays and shallow sandy banks (Albritton 1968; de Heinzelin 1968; Wendorf 1968b; Schild and Wendorf 1989). Lacustrine calcareous deposits and

diatomites (Przybyłowska-Lange 1976; Hill 1989; Marciniak 1989) developed in the ponds and lakes. This unique landscape, known today as El Khefoug land (Said *et al.* 1970, 55; Wendorf and Schild 1976, 90; Schild and Wendorf 1989, 67; Said 1993, 248), was particularly distinctive during the early to final phases of the LPA. It seemed to disappear from most of the areas of the west bank at the

very end of the LPA during the Isnan (Wendorf and Schild 1976, Fig. 49), when thick beds of Nile mud entirely covered the dunes. The demise of the El Khefoug landscape appears to be coeval with the beginning of the first rains in the south Western Desert and a pause in dune displacement and formation.

The prehistoric geomorphic setting along the east bank of the river in Lower Nubia and Upper Egypt seems to have been different. The classic fossil El Khefoug landscape has not been reported from the east bank, except in the Airport Area south of Wadi Halfa (e.g., Marks 1968a, 398), although some of its elements might have been present in the Kom Ombo Graben, an extensive tectonic embayment some 50 kilometres to the north of Aswan.

An interesting hypothesis postulating the existence of a large, Late Palaeolithic Nile lake, called Makhatma lake and located on the east bank between Nag Hammadi and El Abadiya, Upper Egypt, has recently been introduced by Vermeersch *et al.* (2006). Widespread outcrops of black clays in the area are thought to be the remnants of this huge lake, whose origin is seen in the supposed formation of the El Khefoug landscape and the hypothetical formation of a huge dune dam across the Nile Valley, just to the east of Nag Hammadi (Vermeersch *et al.* 2006, Fig. 19), blocking the waters of the main Nile. It is, however, very difficult to imagine how a friable, even very large, sand dune could have resisted the hydrostatic pressure of a deep, nearly one-hundred-kilometre-long lake. On the other hand, except for the black Nilotic clays, presumed to have been formed as a deep water deposit, there are no other lacustrine sediments reported from the area, such as calcareous marls, diatomites, clastic shore and beach deposits, etc. that are so characteristic at Wadi Kubbaniya and in other El Khefoug environments on the west bank. The formation of black clays, nevertheless, may also be explained by the *in situ* enrichment of alluvial fine sediments in the clay particles, a result of vertisol pedogenesis taking place on the floodplain during periods of lower rates of silt deposition.

Not only was the landscape of the Late Palaeolithic Nile largely different from that of today, but also the vegetation that formed in the valley did not resemble today's bucolic scenes, a product of agriculture's dominant role in the valley since Predynastic times. However, a few relics of pre-agricultural landscapes are still preserved in the valley, on some of the islands in the First Cataract area, north of the Old Aswan Barrage. A study of these remains (el Hadidi and Springuel 1978, 1989; Springuel 1981), as well as the extremely rich floral macroremains recovered from the sites of Wadi Kubbaniya (Hillman *et al.* 1989), provide a firm basis for more detailed reconstructions of extinct plant communities once flourishing in Lower Nubia (Schild and Wendorf 1989).

Late Palaeolithic environment and its use

The river was the major factor around which all life in Late Palaeolithic societies revolved. Beyond, it was emptiness without limits, more terrifying than the heavens because there was literally nothing further than the horizon, as seen even from the highest *gebel* (mountain) of the valley's high scarp. Down in the centre of the valley's trench was a river, almost dying in the spring yet huge enough to touch the desert in the late summer and early fall. During the low water stage, the valley flourished with various grasses, tamarisk bushes and pools of water rich in hydrophytic herbs and marsh communities. In the late summer, at the time of flood, only a very narrow belt of the valley was inhabitable. Here were concentrated both humans and beasts. It consisted of dryland plant communities, among which trees and shrubs were the most common, with *Tamarix*, *Acacia*, and doum palm. The plant cover and its distribution in these areas was variable, fluctuating between 10% and 100%. *Acacia albida* and *Laportea arborea* formed thickets that were often impenetrable. Between these two seasonal environmental extremes was a range of ecological niches, often determined by geomorphology and dune development, rich in a variety of plant communities.

The array of mammal species found in these Late Palaeolithic sites proved to be very simple. Three species dominated all the large mammal assemblages in the entire main Nile Valley, from Lower Nubia to Middle Egypt (Gautier 1968, 1976, 1987a; Churcher 1972; Gautier and Van Neer 1989; Baker and Gautier 1997): aurochs (*Bos primigenius*), hartebeest (*Alcelaphus buselaphus*), and dorcas gazelle. Hippopotamus and ass (*Equus africanus*) are the only two other species that occurred; however, they were much less important and often rare. Aurochs and hartebeests provided the largest percentage of mammal protein to Late Palaeolithic hunters. Yet, because of low plant accessibility during the flood, Gautier and Van Neer (1989, 159) postulated that the available biomass of these two species was low, reaching perhaps only a few animals per square kilometre.

Rails (*Rallidae*), mainly the coot, who inhabited marshlands, are the most numerous bird remains in the Late Palaeolithic sites in the main Nile Valley. Geese and ducks are the second in number, making water birds largely dominate the spectra. This water bird spectrum, on the other hand, was primarily composed of migratory birds on their way to or from the deep tropics of Africa (Churcher 1972; Gautier and Van Neer 1989).

Fish remains are a very common element of the faunal assemblages throughout the Late Palaeolithic Nile. They are already present in the Late Middle Palaeolithic Khormusan and the still earlier Site 440, at the Khor Musa wadi south of Wadi Halfa, where several deep-water fishes have been identified (Greenwood 1968). Hominin selective

practices profoundly influenced the ichthyofaunas, particularly at the Late Palaeolithic sites. Massive fish harvests occurred during the yearly flood and/or spawning, as in the case of catfish (*Clarias*) in the Fakhurian materials from the Esna area (Greenwood and Todd 1976) and Kubbaniya (Gautier and Van Neer 1989; Van Neer 1994), or the Idfuan sites north of Edfu (Greenwood and Todd 1976). Catfish and tilapias overwhelmingly dominated the fish faunas at the Afian site of Makhatma 4, north of Qena. The tilapias were caught in their first and second seasons of growth (Van Neer *et al.* 2000; Vermeersch *et al.* 2000c), or – according to the daily growth of otolith rings – between 20 and 220 days of bottom dwelling. The widest rings, however, which indicate optimal nutrition at the time of flood, are found near the parts of the otoliths that formed last. Most of these fall between the 40th and the 80th day of the flood (Van Neer *et al.* 1993, 2000). The deep-water channel fishes, such as *Bagridae* and *Lates*, are almost entirely absent from the recovered Late Palaeolithic ichthyofaunas of the main Nile Valley. They do appear, however, in large quantities in the final Late Palaeolithic Arkinian materials from Dibeira West 1, near Arkin, in Sudanese Nubia (Gautier and Van Neer 1989, 153). This fish evidence may suggest that deep Nile channels in the time of the last Pleniglacial were rather rare.

Exploitation of wild plant foods was, along with fishing, a major source of protein and other nutritional elements. The charred remains of plant foods recovered from the Late Palaeolithic Kubbaniyan sites in Wadi Kubbaniya are the most diverse assemblages ever recovered from an Old World Late Palaeolithic site (Hillman *et al.* 1989). Tubers of *Cyperus rotundus*, or purple nut-grass, predominate among the collected samples. Charred seeds of club-rush and seeds from the tribe *Artemidae* (chamomile) are also found embedded in preserved human faeces in the Kubbaniyan camps. Charred fragments of endocarps identified as originating from the dom palm suggest an ancient use of this edible fruit (Hillman *et al.* 1989).

The availability of food resources in the highly seasonal main Nile Valley determined Late Palaeolithic life. Hunting of large mammals was possible throughout the year, although they would concentrate in the near-desert belt only during the flood season. Flood and basin fishing was best at the very beginning of the inundation, during its peak, and then during its recession. Fowling was best during the winter, from November through February, while the wetland tubers' season extended from November until May. Dom palm fruits were available from February through late April, and the club-rush and chamomile seeds were ready to collect in winter and spring. Finally, during the low water stage, from mid-March to mid-May, shellfish banks were exposed and ready to be gathered, as at the sites in the El Kilh area, north of Edfu (Wendorf and Schild 1976, 29).

Fitting people into the environment

Except for a few marked pauses (Schild and Wendorf 1989, 92) in the pace of the Late Palaeolithic Alluviation, there are no discernible changes in the Nilotic environment between about 25 cal ka BP and 14.5 cal ka BP. We do not know what the valley was like when the low desert Nazlet Khater mine located between Asyut and Sohag was being exploited by the first Upper Palaeolithic people known in the valley, some 36–26 cal ka ago (Vermeersch *et al.* 1995, 28). It was the time of MIS 3 and a relatively mild climate (van Andel 2002); the Nile was most probably down-cutting. We know a bit more about the environment at the time of the latest Late Palaeolithic people in the Nile Valley, the Arkinians, known from Sudanese Lower Nubia. At the time of the Arkinian, during the cold pulsation of the Younger Dryas (GS-1), and between the cataracts, the Nile had already undergone a major incision and descended to nearly 12 m below the silts deposited just before the beginning of the Greenland Interstadial 1 down-cutting. The river stopped at this level to aggrade again for a while. This was the Arkin Aggradation discussed by de Heinzelin (1968). The time was about 12.8–12.4 cal ka BP (Wendorf *et al.* 1979) and the climate was most probably relatively cold because we were in the first half of the Younger Dryas, a considerable world-wide climate cooling. However, the mammal spectrum was the same as before, the ever-present duo of aurochs and hartebeest with an occasionally bagged hippo. In contrast to the previous aggradations, the main channel at this section of the valley was deep, providing good fishing.

Basic “cultural” taxonomic entities in Sudanese and Egyptian Nubia, between the Second and the First Cataracts

In 1968, just after the Nubia Salvage Campaign, the taxonomic grouping of most of the rescued Late Palaeolithic assemblages in Sudanese and Egyptian Lower Nubia located between the First and the Second Cataracts was proposed by Marks, Schild, Shiner and Wendorf (Wendorf 1968a; see also Wendorf 2008). All of the units, except for the redefined Sebilian, were new and were placed in the framework of Nilotic geological events as then understood (de Heinzelin 1968). The final radiochronology (Fig. 7.4), on the other hand, was determined later, making the original dating most probably too recent (Wendorf *et al.* 1979).

METHODS OF STONE KNAPPING AND LITHIC TECHNOLOGY

Not very surprisingly, Nile Valley Late Palaeolithic technology is guided by raw material availability. From the Second Cataract to Kalabsha (First Cataract) practically the only material in the valley are the pebbles and gravel from Batn el Hadjar, composed of Hudi chert and agate. In addition,

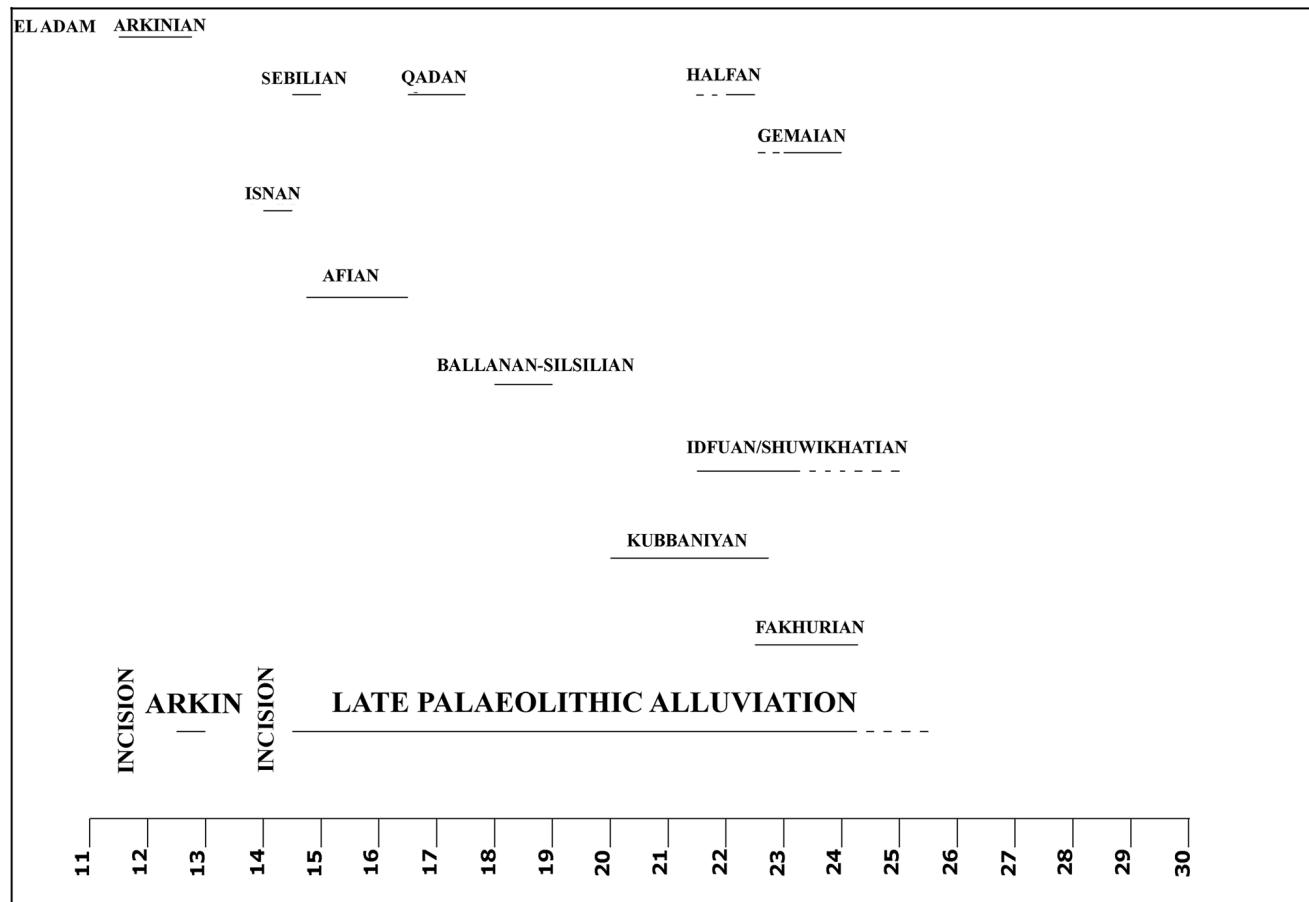


Figure 7.4. Tentative chronology of the Late Palaeolithic taxonomic units in Lower Nubia and Upper Egypt in cal years BP.

ferruginous quartzitic metamorphosed sandstone embedded in the Nubia Formation Cretaceous sandstones is available along the Cretaceous cliffs and gebels of Nubia. The latter, however, was very rarely used in the Late Palaeolithic except for the Sebilian, which clearly demanded much larger blanks. From Kalabsha north, the Eocene Plateau with its high quality chert beds grows closer and closer to the valley, and from Esna to Cairo it forms its scarps. However, from Aswan downriver, the lateral wadi system brings into the valley Eocene chert cobbles and pebbles from the interior of the deserts, a much better source of this material. As a rule there is not much one can do with small cobbles and pebbles. Thus, the array of cores is limited to unprepared, except for platforms, single, opposed and changed orientation (among these globular and 90 degree) cores. The exception are well prepared Levallois cores and Levallois-derived Halfa cores. There are also semi-Nubian, Gemaian point cores, resembling a simplified Nubian core of Levallois method (Guichard and Guichard 1965, 68). It is also in the southern area of Lower Nubia where counter shock, bipolar cores are present in considerable numbers, *e.g.*, in the Arkinian.

The Gemaian

The Gemaian was first described by Shiner (1968) as the first segment of his Cataract Tradition taxonomic unit. None of the eight described, rather poor, assemblages has been radiocarbon dated. All of them occur on the right bank of the river, just to the north of the Second Cataract. The Gemaian sites seem to be embedded in lower parts of the Late Palaeolithic Alluviation beds, some 8–10 m below those of the nearby Halfan loci, and, therefore, should be placed in time near the Halfan, but most probably slightly earlier, perhaps before 22 cal ka BP.

The Gemaian is a strange collection of lithics (Fig. 7.5). With a raw material economy based on Nile pebbles, mainly chert, it is not so microlithic as the Halfan. Its core technology is quite erratic. Both plain Levallois (Fig. 7.5, 5) and Halfan recurrent cores are present, as well as strange point cores that resemble the Nubian core of Levallois method in having two flake scars on the distal part of the flaking surface (Fig. 7.5, 1, 6–7). Non-Levallois cores are not very evident. The tool-kit is dominated by denticulates, sometimes small Tayac points (Fig. 7.5, 11–12), and notches. Burins (Fig. 7.5, 13),

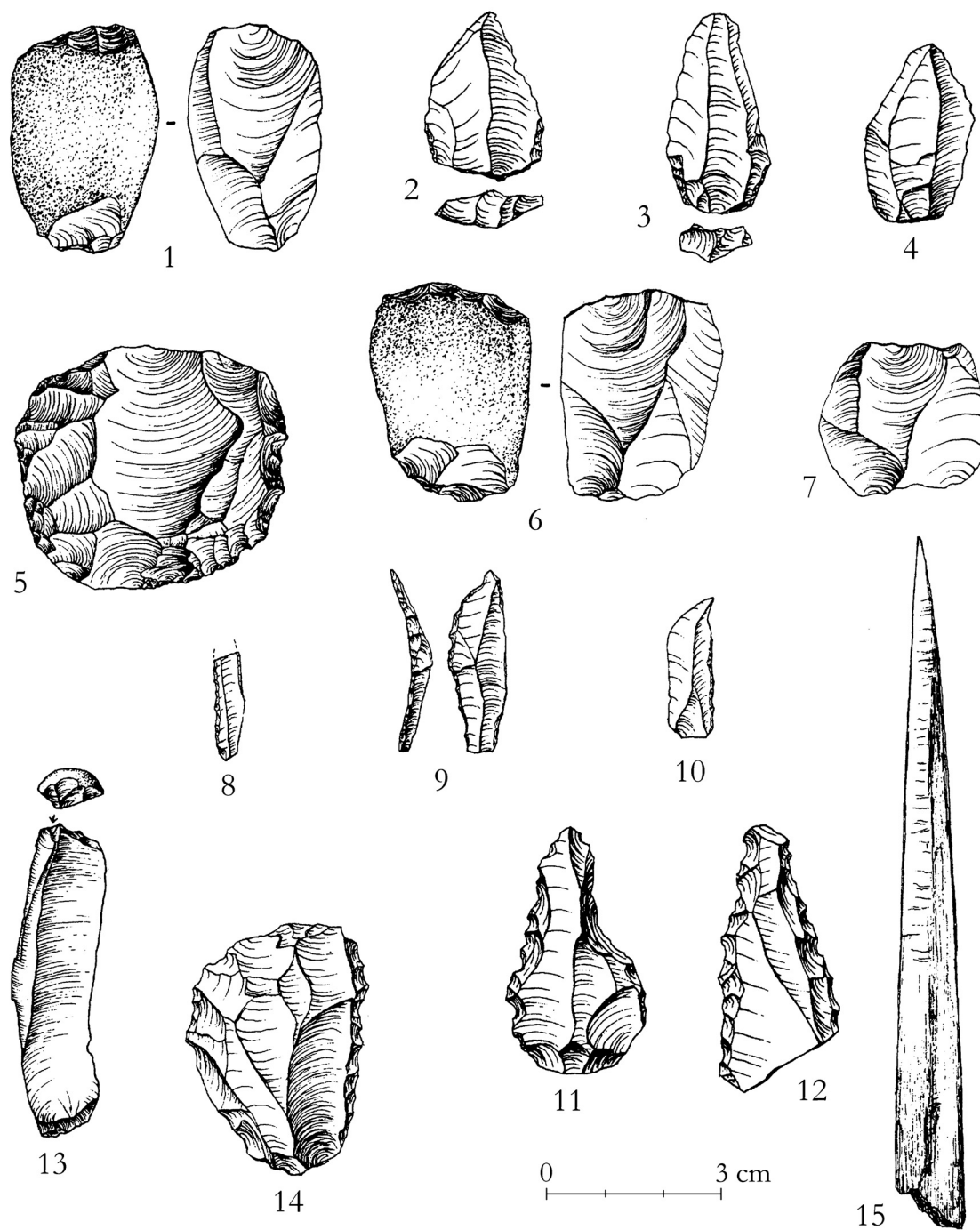


Figure 7.5. Gemaian: Sites 1025 (1–4, 6–7), 2009 (11–12), 412 (8–10, 14–15), and 278–4 (5, 13). 1, 6–7: Gemaian point cores; 5: Levallois flake core; 2–4: Gemaian points with basal blunting; 8–10: Ouchtata bladelets; 11–12: Converging denticulates; 13: Burin; 14: Sidescraper; 15: Bone point.

sidescrapers (Fig. 7.5, 14), and endscrapers are present in addition to truncations and rare backed and Ouchtata pieces (Fig. 7.5, 8–10). Of interest are adze-like tools (cores?) with

invasive retouch on one face and cortex on the opposite face. At Site 412, a nice long point made of a long bone has also been found (Fig. 7.5, 15).

The Halfan

The Halfan sites at the time of the Nubia Campaign were assigned to the so-called Ballana recessional event that separated the Dibeira Jer and Sahaba Aggradations (Marks 1968a). Today, the Dibeira Jer has been subsumed by the Middle Palaeolithic Alluviation phase, and the Ballana geomorphological setting is simply an El Khefoug landscape, probably belonging to the relatively slow-accumulation early phase of the Late Palaeolithic Alluviation, and best represented at Wadi Kubbaniya. The sites cluster around Wadi Halfa, on both banks of the Nile. Four radiocarbon dates associated with the Halfan entity range from $24,700 \pm 2500$ (GXO-440) BP at Site GB-32, excavated by the Irwins (Irwin *et al.* 1968), to *c.* 16.5 ka at Site 443 (Marks 1968a), or from *c.* 28 to *c.* 19.5 cal ka BP. The two extreme dates are erratic, and the remaining assays of *c.* 22 and 22.5 cal ka BP may best fit the Halfan geologic placement.

The Halfan raw material economy is almost solely created using small Nile pebbles, the Batn el Hadjar chert and agate, which results in the small and microlithic appearance of the lithic artefacts. The technology is based on the Halfan (Fig. 7.6, 2, 4–5) and Levallois cores, using small pebbles and with a certain amount of unprepared, opposed and single platform (Fig. 7.6, 11–12), discoidal (Fig. 7.6, 1), and changed orientation cores (Fig. 7.6, 3) for flakes, which are sometimes elongated. Various Ouchtata bladelets (Fig. 7.6, 13–18) are common as well as delicately backed pieces (Fig. 7.6, 6–7), small burins, sidescrapers and endscrapers. Notches and denticulates form a solid background element. Of organic artefacts, ostrich eggshell beads are present, but rare. The sites are rather small, however they are thick in occupation debris and rich in artefacts, indicating repetitive, almost certainly seasonal occupations.

The Qadan

The Qadan is the second stage of Shiner's (1968) Cataract Tradition. It occurs at least from Abka, below the Second Cataract, to Wadi Kubbaniya, below the First Cataract (Banks 1980). Of the five radiocarbon dates associated with the Qadan, three are certainly too late, falling within either the early or late Holocene. Of the two remaining assays, one of $14,500 \pm 490$ (WSU-315) BP is from Site 8905, near Tushka and embedded in a Late Pleistocene dune remnant (Wendorf 1968b); the other of $13,740 \pm 600$ BP (Pta-116), on bone collagen, is from the famous cemetery of Gebel Sahaba (Wendorf and Schild 2004). When calibrated, the dates occur around 17.5 and 16.5 cal ka BP, overlapping within one Σ . This is the age of the late last Pleniglacial and the upper Late Palaeolithic Alluviation.

The raw material is again based on Nilotic pebbles, mainly Hudi chert. The technology is dominated by non-Levallois single and opposed platform (Fig. 7.7, 18) cores for flakes and bladelets, followed by changed orientation

and ninety-degree specimens. Discoidal and Levallois recurrent flake cores are not present in most of the assemblages and are extremely rare in the others. The tools are small and microlithic backed pieces are very frequent (Fig. 7.7, 1–7), consisting primarily of fully arched (segments), sub-triangular, pointed and arched or, rarely, blunt-tipped flakes with thick backs, frequently retouched on an anvil. Truncations are numerous (Fig. 7.7, 8–10), and burins (Fig. 7.7, 13–15), endscrapers and sidescrapers (Fig. 7.7, 11–12) are present. The omnipresent notches, denticulates and scaled pieces (Fig. 7.7, 16–17, 19) are variable in number. Bone tools are very rare. Grinding implements consisting of both upper and lower grinding stones, often pecked, are common, particularly in dune environments like the ones at Tushka. They were most probably used to process tubers (cf. Hillman *et al.* 1989, 190; Jones 1989).

Two important cemeteries contain Qadan people: one on Gebel Sahaba (Anderson 1968; Wendorf 1968c; Wendorf and Schild 2003, 2004; Judd 2006), and the other at Site 6905 at Tushka (Anderson 1968; Wendorf 1968b). The population from Gebel Sahaba and other Nubian sites (Greene and Armelagos 1972), as well as from the Nazlet Khater 4 grave (Thoma 1984), constitute a quite uniform Late Pleistocene population, distinct from that of the contemporaneous Maghreb (Irish 2000). The burial grounds of Gebel Sahaba are evidence of inter-communal warfare.

The Ballanan-Silsilian

The only Ballanan sites in Lower Nubia lie near the old village of Ballana, a few kilometres upstream from the original location of the Ramses II temples of Abu Simbel. The sites are embedded in the top sand of dune remnants interfingering with silts. At Sites 8897 and 8863 these dunes are covered by a thin veneer of Late Palaeolithic silts. Judging from the elevation of these silts at Site 8863, their deposition occurred near the end of the LPA phase (Wendorf 1968b, 849), a conclusion not supported by most of the radiocarbon determinations. At Site 8896, a charcoal sample (WSU-329) yielded a calibrated date of around 17–16 ka ago (one Σ), thereby assigning the Ballanan to nearly the end of the Late Palaeolithic Alluviation. Another date (GXO-120), however, from Site 6-B-27 (Wendorf 1968b, 853), situated on the west bank opposite Wadi Halfa (Irwin *et al.* 1968), and stratigraphically linked to a Ballanan-like assemblage, suggests an age of around 19–17 cal ka BP (one Σ).

The raw materials in the Nubian Ballanan are closely linked to the Nile and are highly dominated by chert pebbles. The technology is a non-Levallois one, based on single and opposed platform cores for blades (Fig. 7.8, 1–2), bladelets and flakes. Changed orientation and ninety-degree specimens also occur as well as splintered pieces (bipolar, counter shock cores?). The Ballanan-Silsilian is basically a bladelet industry dominated by truncations, often with Krukowski's

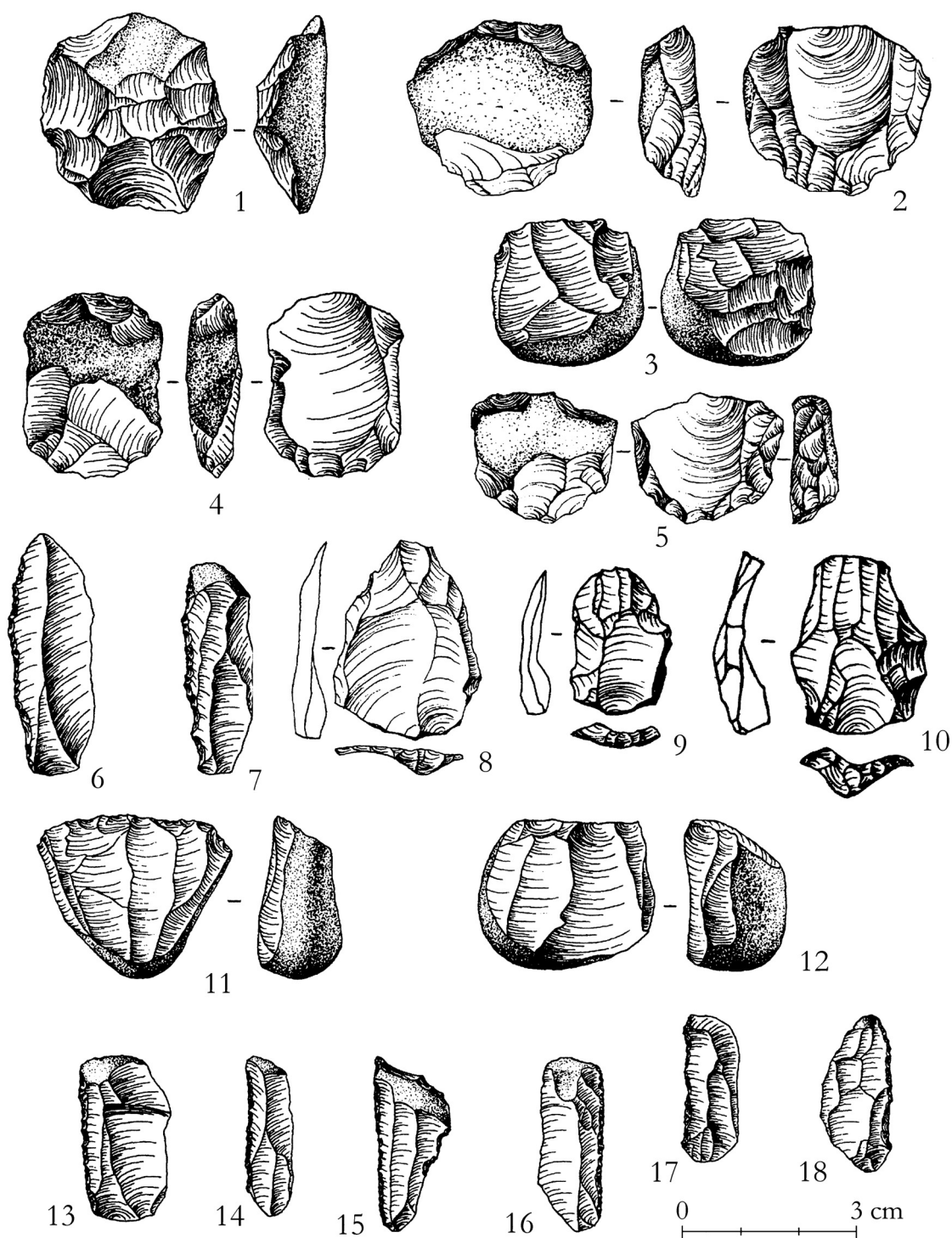


Figure 7.6. Halfan: Sites 443 (1, 3, 6–7, 11–12, 13–18) and 1018 (2, 4–5, 8–10). 1: Discoidal core; 2, 4–5: Halfa cores; 3: Changed orientation core; 6–7: Backed blades; 8–10: Halfa flakes; 11–12: Single platform cores; 13–18: Ouchtata bladelets.

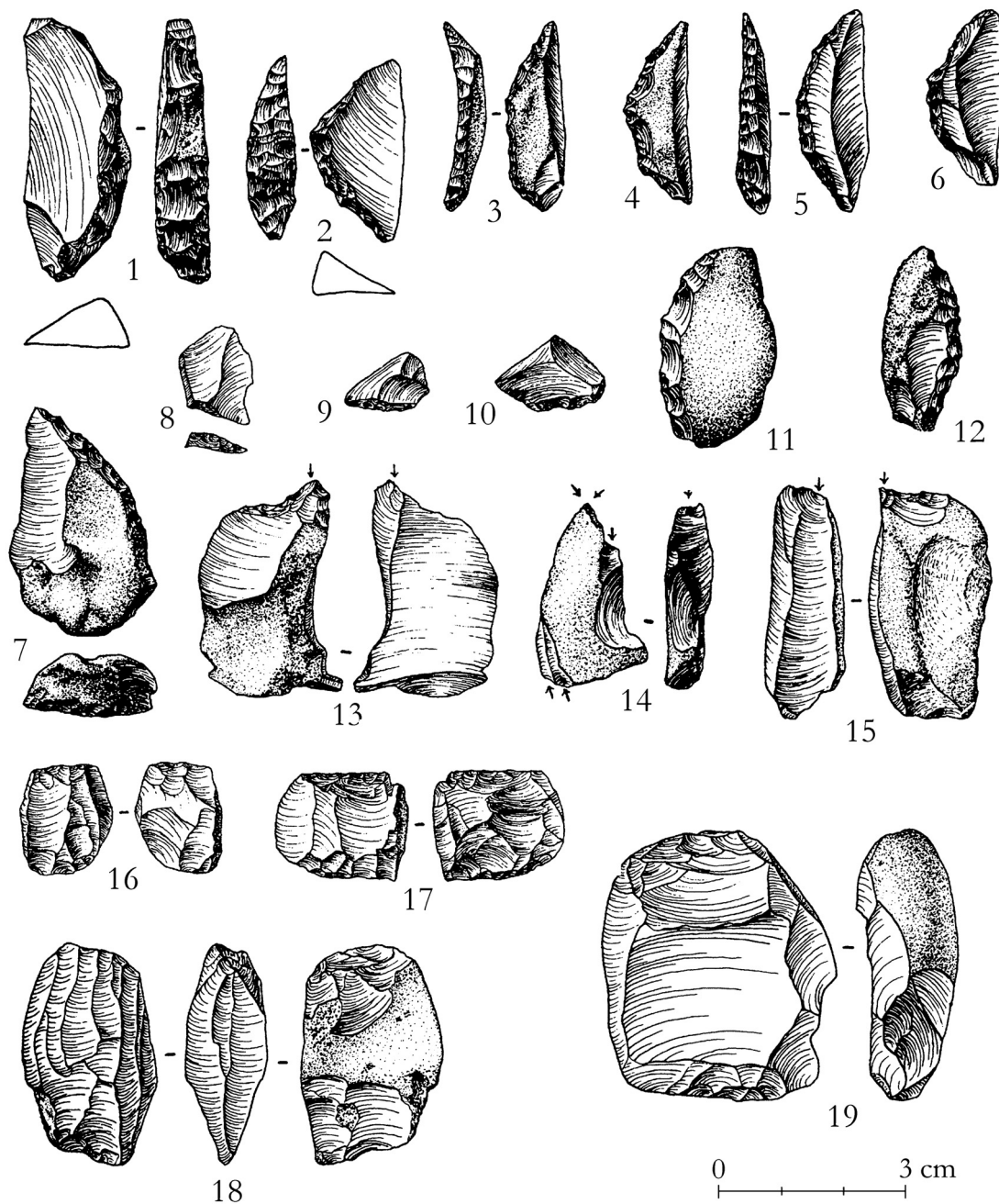


Figure 7.7. Qadan: Sites 8905, Locality A (18–19), Locality B (11–12), Area C (1–10, 13–17), Tushka area. 1–6: Fully arch-backed pieces; 7: Arch-backed flake; 8–10: Basal truncation on flakes; 11–12: Sidescrapers; 13–15: Burins; 16–17, 19: Scaled pieces; 18: Opposed platform bladelet core.

microburin scar (Fig. 7.8, 9–13), and backed pieces, frequently arch-backed bladelets (Fig. 7.8, 7–8). Ouchtata pieces are present, but rare. Burins are present (Fig. 7.8, 6) while endscrapers are extremely rare (Fig. 7.8, 5). Some of the sites are large and very thick (*e.g.*, 8956), suggesting multiple reoccupations.

The Ballanan is quite similar to the Silsilian from Kom

Ombo (Smith 1966, 1967, 1968; Phillips and Butzer 1973) and the assemblage from Site E71K20, in the Isna area (Wendorf and Schild 1976, 269). The ^{14}C dates from Gebel Silsila 2B, Area II (Phillips and Butzer 1973) place the Silsilian around 18.7 cal ka BP (Y-1376) and 17.5 cal ka BP on shell (I-5180), or within the same time range as the Ballanan in Sudanese Nubia. A few Ballanan-Silsilian sites

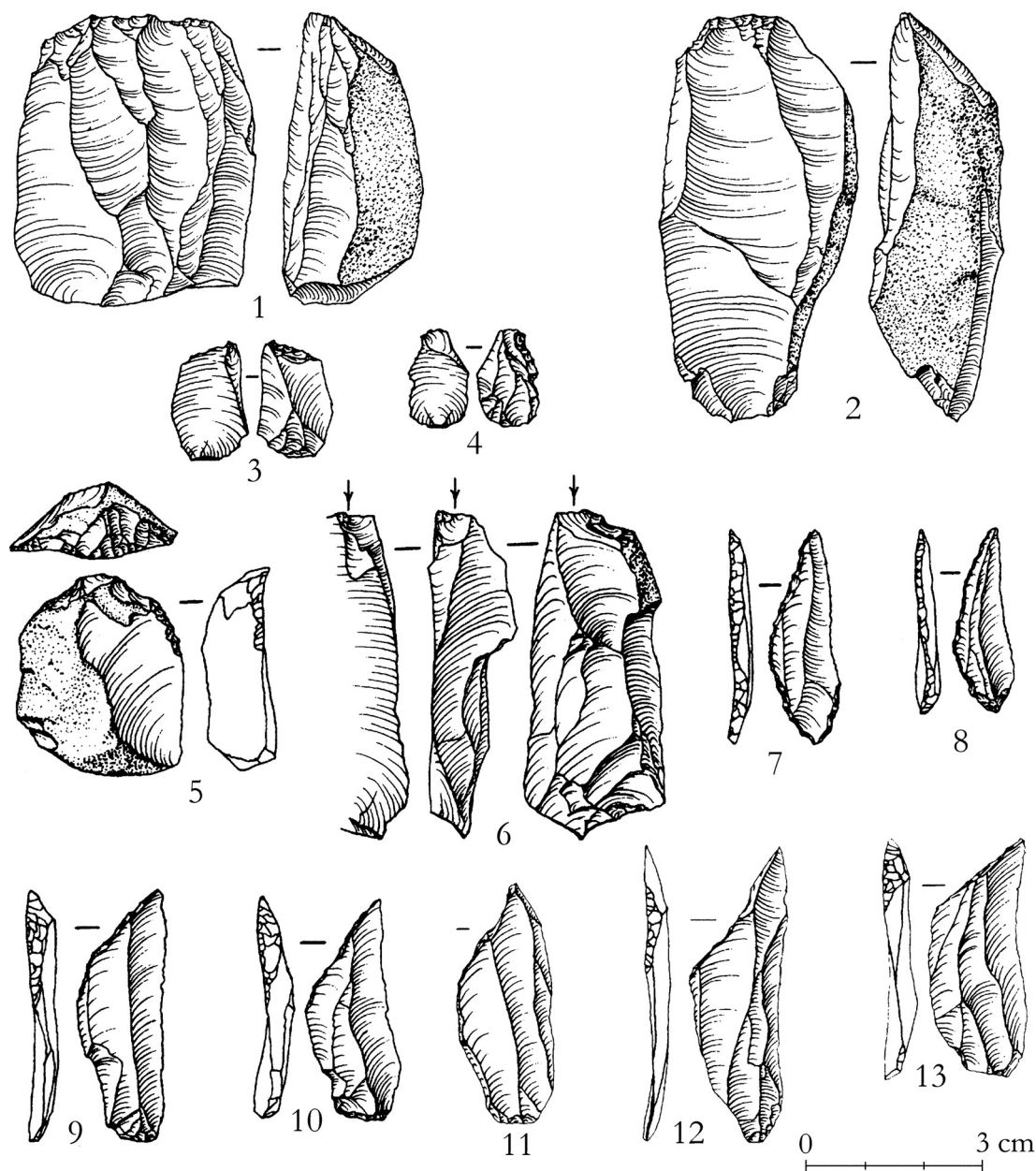


Figure 7.8. Silsilian: Site E71K20, Area B, Esna area. 1–2: Opposed platform blade cores; 3–4: Simple microburins; 5: Endscraper; 6: Burin; 7–8: Arch-backed bladelets with retouched bases; 9–13: Truncated blades; 12: with microburin scar on tip.

(E-78-5e, E-78-5f (?), E-84-2) have been reported from the mouth of Wadi Kubbaniya (Kobusiewicz 1989a, 1989b; Wendorf and Hill 1989), of which E-78-5f yielded a radiocarbon date of about 19 cal ka BP (Gd-2094) (Wendorf and Hill 1989, 680), and at Shuwikhat, Site 2, near Qena (Vermeersch *et al.* 2000a).

The Sebilian

The Sebilian (Marks 1968b; Wendorf 1968b; Hassan 1972;

Hassan and Wendorf 1974) is clearly a Nubian entity, although its northernmost sites occur near Edfu and the Dishna area in Upper Egypt (Hassan 1972; Hassan and Wendorf 1974; Wendorf and Schild 1976, 290). In Sudanese Nubia, near Khor Musa, a recently deflated site (1024), laying near the highest reach of the Late Palaeolithic Alluviation, produced two radiocarbon assays of about 13 cal ka BP (WSU-144, 188) (Marks 1968b, 512). At Site 34, Dibeira East, two samples of shell yielded dates uncorrected

for fractionation (de Heinzelin 1968, 38) of around 13.3 cal ka BP (WSU-104, WSU-189). These uncorrected dates have to be considered minimal and most probably too young. The geomorphological context of the Sudanese Sebilian occurrences prompted de Heinzelin to associate them with the highest floods of the Sahaba Aggradation, *i.e.* the LPA. At Site E61M1B in the Dishna area, below Qena, the Sebilian lithics are embedded in the topmost Late Palaeolithic silts. If this assumption is right, the Sebilian should date with the latest silts and perhaps the beginning of Bølling, or around 14.5 cal ka BP (see a more extensive discussion on Sebilian dating in Schild and Wendorf 2004).

Again, the Sebilian is a very particular association of lithics. Its raw material economy in Sudanese Nubia is based on ferruginous quartzitic sandstone and in Egypt on Eocene chert, the so-called Egyptian flint. Clearly, the large size of the nodules mattered to the Sebilian stone knappers. At first sight, a Middle Palaeolithic mode of flake production governs the technology. Discoidal (Fig. 7.9, 1) and Levallois (Fig. 7.9, 2) cores, both of recurrent and single removal (preferential) variants, are making most of the core inventory. The Levallois index is prominent, but not very high (10–15%). Truncated (Fig. 7.10, 3–4, 7), truncated and backed flakes (Figs. 7.9, 4–5 and 7.10, 6, 8), as well as double truncated flakes (Figs. 7.9, 6 and 7.10, 3–4), sometimes trapezoidal (Fig. 7.10, 1–2), provide the largest tool counts. Endscrapers (Figs. 7.9, 3 and 7.10, 10), sidescrapers and burins are rare. Notches and denticulates are present. Of interest is the classic microburin (Fig. 7.10, 5) technique performed on large blanks. Sebilian sites range in size from small to very large, *e.g.*, Site 1042 in Sudanese Nubia measures about 5,000 sq. m.

The Sebilian has no analogy in the north-eastern African world. Marks (1968b, 529) has linked it with the lower Tshitoli of J. D. Clark (1963) in Angola, showing very close analogies in technology and tool types. Also, the age of the Tshitoli is similar to that of the Sebilian. Both may be placed in the onset of Bølling, when the increased rainfall over equatorial Africa stimulated northward migration of the local human population, accompanying the northward expansion of the monsoonal rain belt.

The Arkinian

The Arkinian (Schild *et al.* 1968) has only been recognized at a series of occurrences at Arkin, near Dibeira West. At Dibeira West 1 (DIW 1) the oldest Arkinian site (Industry A) is embedded in the topmost Nilotic sands of the Arkin Aggradation and dates about 12.8–12.4 cal ka BP. A younger (Industry B) site is embedded in topmost Nilotic sand overlying the truncated deposits of Industry A (cf. de Heinzelin 1968, Atlas, Fig. 41). A series of sites rest on exposed, deflated surfaces of sand and silt deposited during the aggradation. They probably date within the early Holocene, perhaps between 12 and 10 cal ka BP. The later

Arkinian probably also occurs during a wet period (Schild and Wendorf 2002) in the south Western Desert of Egypt (El Adam wet interphase).

The raw material economy of the Arkinian is based on relatively large Nile chert and agate pebbles and small cobbles. The technology is supported by single (Fig. 7.11, 7) and opposed striking platform cores for bladelets and flakes, as well as by cores with changed orientation. Various cores for flakes are also present (Fig. 7.11, 4). Not very prominent, but quite visible, are splintered pieces, or bipolar cores on small cobbles (Fig. 7.11, 1) that yield large cortex flakes used especially to make endscrapers (Fig. 7.11, 2–3, 5–6). Stone anvils serving this technology are a common phenomenon at the Arkinian sites (Fig. 7.12, 24). Tool-kits are dominated by backed pieces, mostly bladelets, pointed with arched (Fig. 7.12, 3–11) and straight backs (Fig. 7.12, 1–2). Of interest are very thick, orange section-like, arch-backed pieces on flakes with direct (Fig. 7.12, 16) or on an anvil retouch (Fig. 7.12, 15). There are also segments (Fig. 7.12, 17–20) and blunt-tipped specimens. Ouchtata pieces are present (Fig. 7.12, 12–14). Endscrapers are numerous, mostly on large cortex flakes (Fig. 7.11, 2–3, 5–6, 8). Burins are rare, while triangles (Fig. 7.12, 21) and elongated backed rectangles on bladelets occur occasionally (Fig. 7.12, 22–23). There are also small choppers on quartz pebbles (cores?), common grinding implements and a few bone spatulas (Fig. 7.11, 11). The sites are very dense and rich, clearly exhibiting many repeated occupations.

Numerous late Arkinian occupations are known also from the Nubian Desert under the name of El Adam Variant. These desert settlements occur just over a hundred kilometres to the north-west of Arkin at Nabta and El Adam Playas. The oldest of these at Site E-79-8, El Adam Playa, dates between *c.* 12 and 10.7 cal ka BP (Schild and Wendorf 1984, 28).

Basic “cultural” taxonomic entities in Egyptian Nubia and Upper Egypt, between the First Cataract and Dishna

Most of our knowledge about the Late Palaeolithic of this area comes from the work at Wadi Kubaniya, Edfu, Isna, and Qena (Wendorf and Schild 1976, Wendorf *et al.* 1989; Vermeersch 2000). A short summary of the taxonomy of Late Palaeolithic sites in the Kom Ombo area, in northern Nubia, has also been introduced by P. Smith (1966, 1967, 1968), who briefly described most of the units for the first time. A much more detailed study produced a monograph of a Silsilian Site GS-2B-II, in the Kom Ombo plain (Phillips and Butzer 1973).

METHODS OF STONE KNAPPING AND LITHIC TECHNOLOGY

Crossing the First Cataract takes a northward traveller into

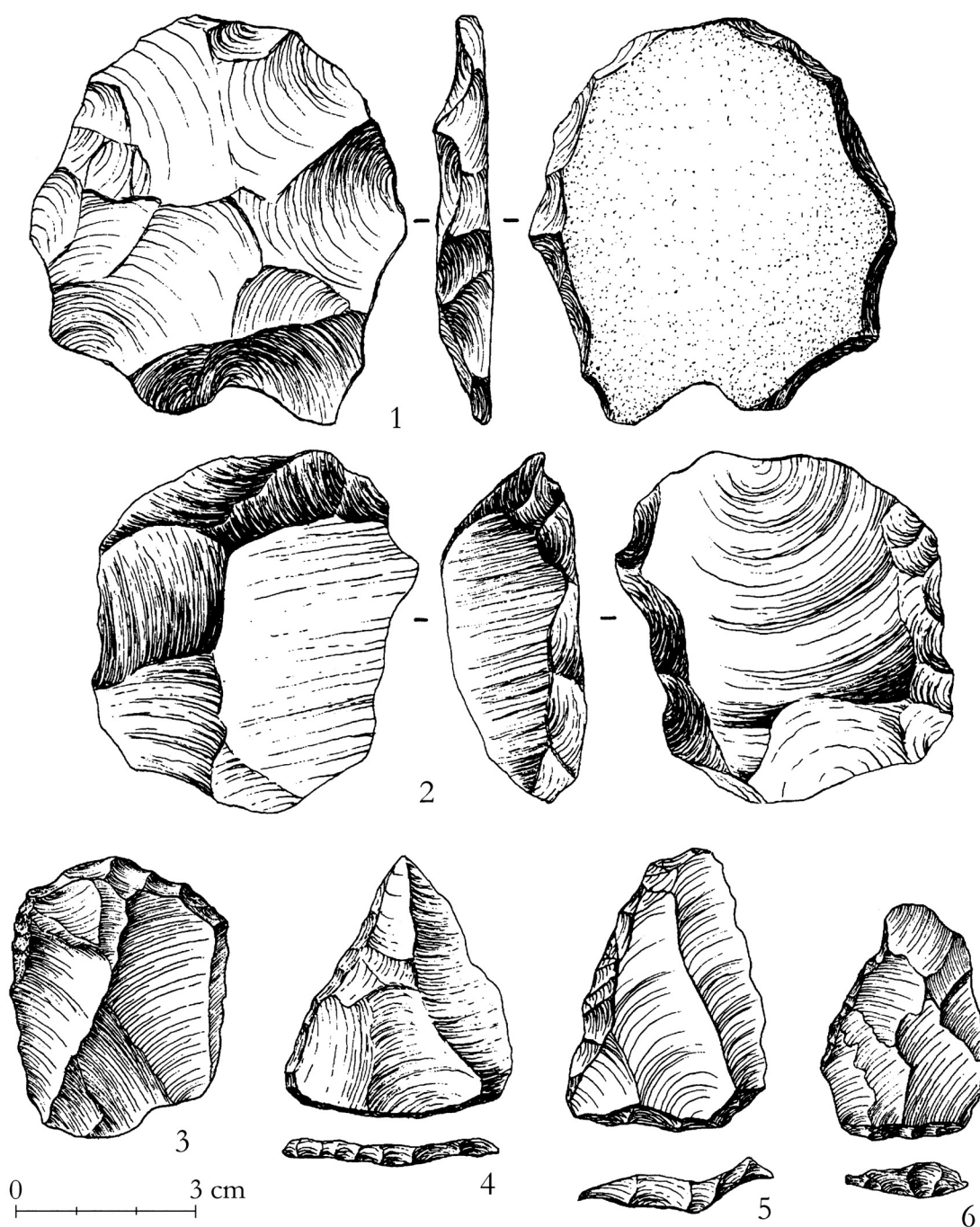


Figure 7.9. Sebilian: Sites 83, Gebel Sahaba area (1–2, 4–5) and 2010B, Wadi Halfa Airport Area (3, 6). 1: Discoidal core; 2: Preferential Levallois flake core; 3: Endscraper; 4–5: Backed and basally truncated flake; 6: Basally and obliquely truncated flake.

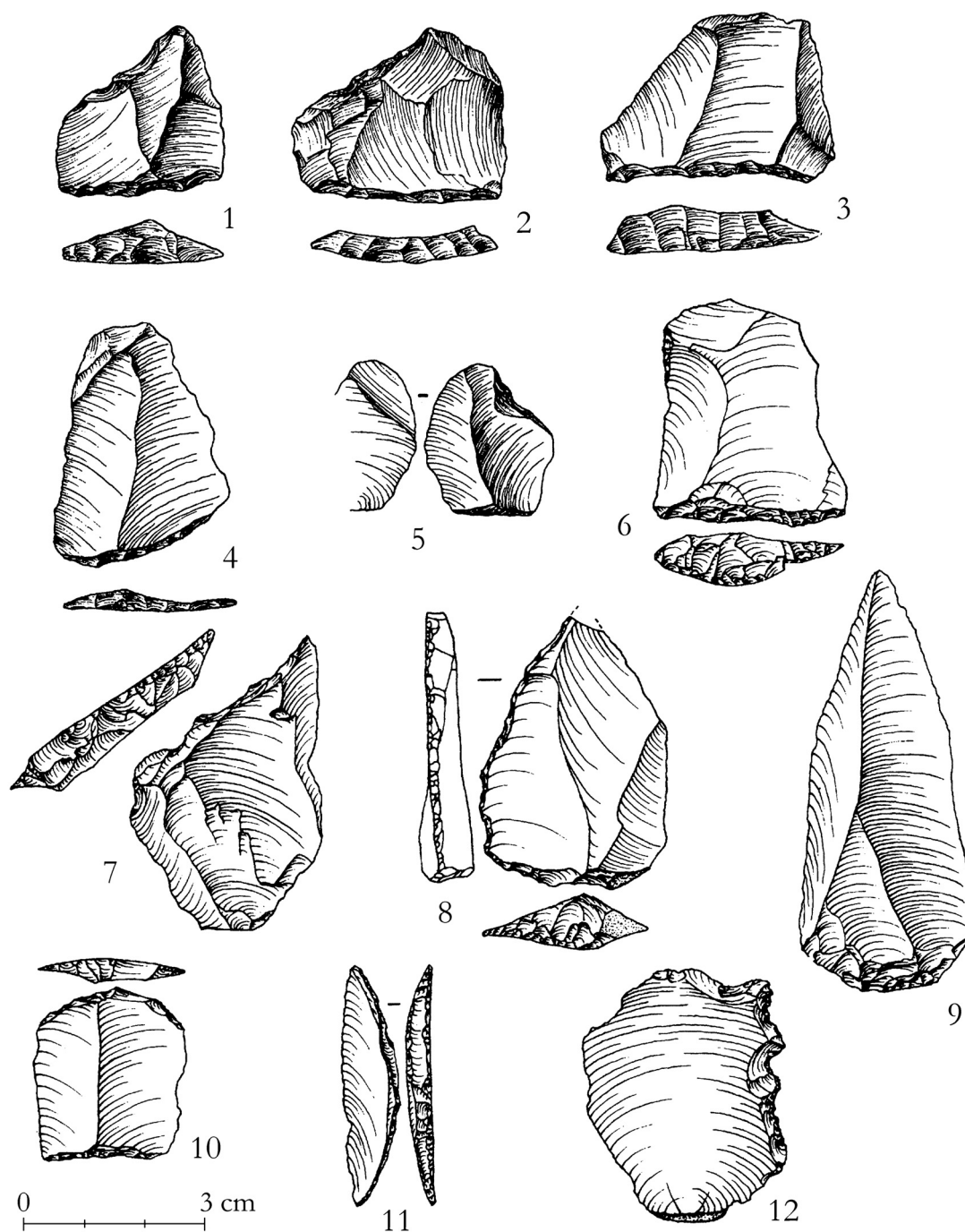


Figure 7.10. Sebilian: Sites 2010B (1–5) and 1042 (6), Second Cataract area; E-61M1 (7–12), Dishna area. 1–2: Basally and obliquely truncated flakes; 3–4: Basal truncation on flakes; 5: Simple microburin; 6, 8: Backed and basally truncated flakes; 7: Oblique distal truncated flake; 9: Levallois point with basal thinning; 10: Endscraper; 11: Fully arch-backed piece (segment); 12: Bec.

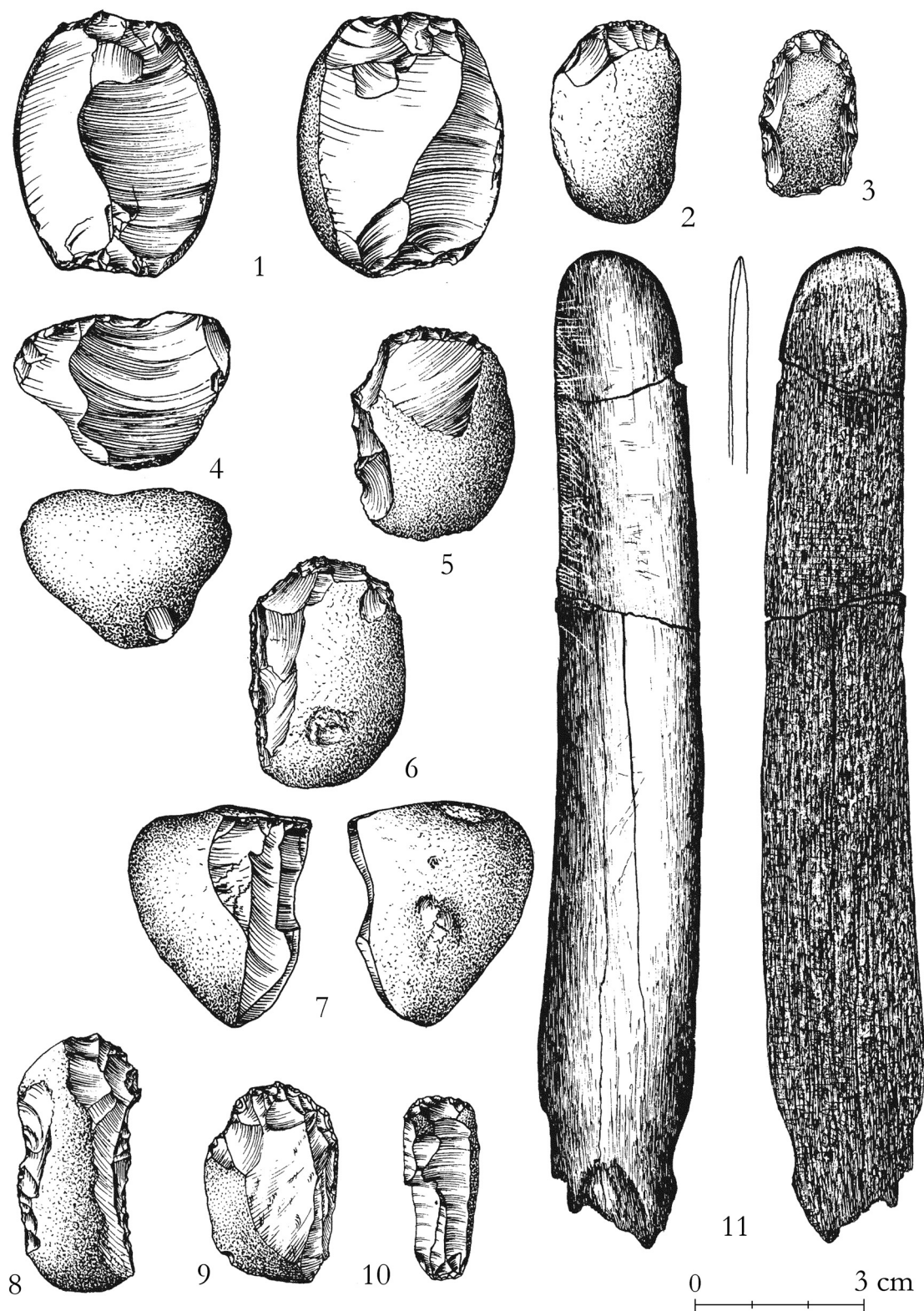


Figure 7.11. Arkinian: Site DIW 1, Concentration B (1–3, 5–6, 8–10, 11), Concentration A (4, 7). 1: Splintered pebble (bipolar core); 4: Single platform flake core on a pebble; 2–3, 5–6, 8–10: Endscrapers on cortex flakes; 7: Single platform bladelet core on a pebble; 11: Bone spatula.

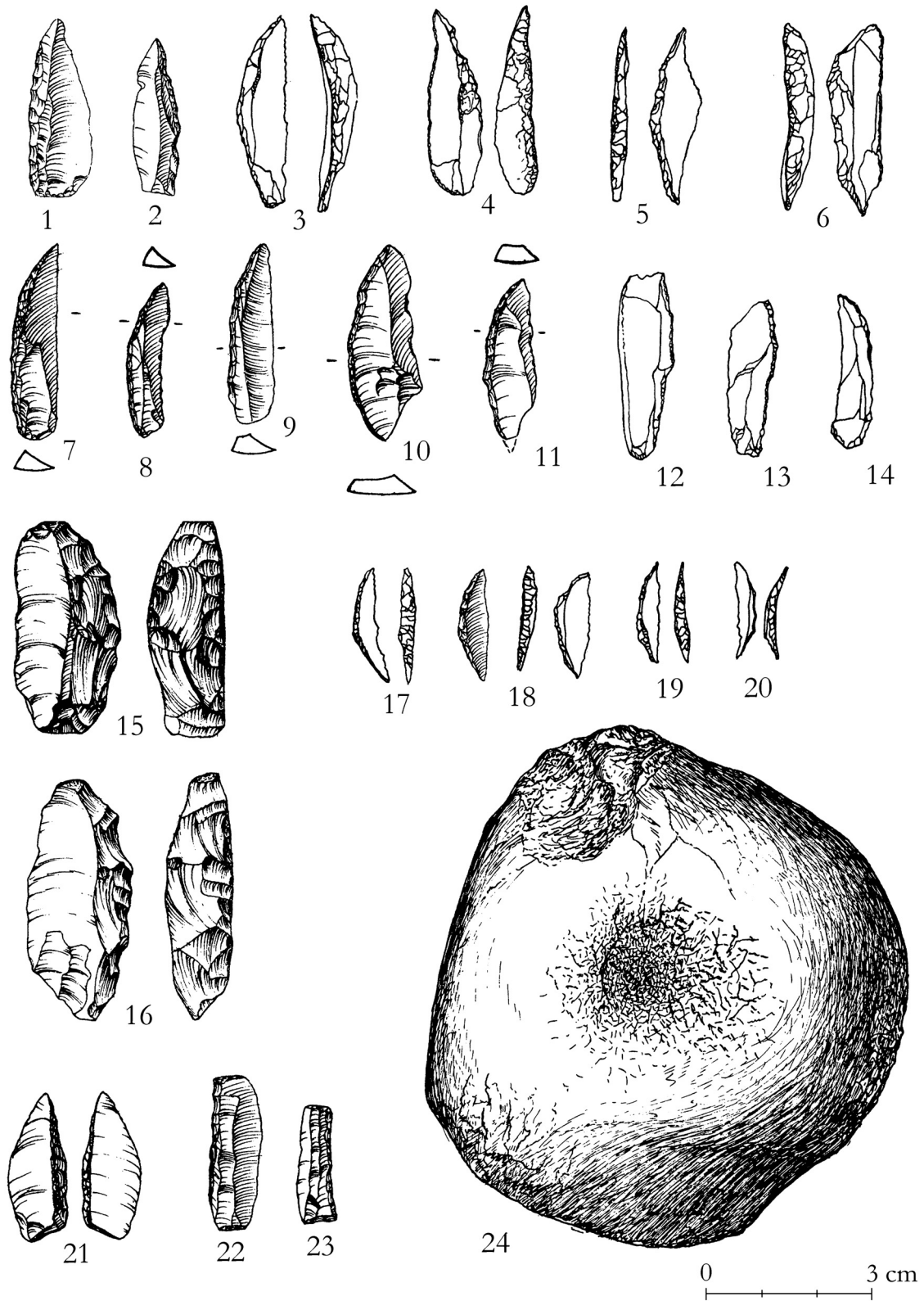


Figure 7.12. Arkinian: Site Dibeira West 1, Concentration A and A Trench (1–6, 17–20), Concentration I (7–11, 15–16, 21–23), Concentration E (24). 1–2: Straight-backed pointed bladelets; 3–11: Arch-backed bladelets; 12–14: Ouchtata pieces; 15–16: Arch-backed pieces with thick back; 17–20: Fully arch-backed bladelets (segments); 21: Scalene triangle; 22–23: Elongated backed rectangles; 24: Pitted anvil.

a new world, rich in raw material resources. It is a country with abundant good quality chert, particularly in the areas where the river approaches or cuts through the Eocene Plateau, that is, downstream from Esna. But even upstream of Esna, many wadis entering the Nile Valley from the west bring with them numerous cobbles of good quality Eocene chert that originate in their headwaters on the plateau. The availability of good chert material increases northwards, and from Edfu on, Eocene chert is plentiful.

This relatively easy access to raw material resources is reflected in not only the composition of the stone assemblages, but also in the mean sizes of blanks. This change, however, has not yet become obvious in the Late Palaeolithic occupations dotting the mouth of Wadi Kubbania, on the west bank, some 20 km north of Aswan.

The Levallois method of flaking is present in the Nile Valley until the Afian entity, although even then a very specialized, bent Levallois technology exists (Schild 1971). Near the end of the Late Palaeolithic, in the Sebilian, the Levallois method of flaking is prominent; however, classic discoidal cores are also common. There are, on the other hand, several entities and/or phases during which the Levallois method seems to have not been employed, as in the Shuwikhatian, non-Levallois Idfuan, Fakhurian, lower Kubbanian, Ballanan-Silsilian and – perhaps – Qadan (see discussion in Schild and Wendorf 2004).

In the northern section of Lower Nubia's valley, Late Palaeolithic people using larger nodules of Eocene chert preformed their cores, often very elaborately. They usually exercised a soft stone and soft hammer technique for flaking. In this respect, the common use of hard hammer in the Isnan is an exception.

The Fakhurian

The Fakhurian is known from three sites in Kubbania, stratigraphically placed at the base of the Late Palaeolithic Alluviation sequence (Schild and Wendorf 1989; Wendorf and Schild 1989a), and six sites in the Esna area, five around the monastery of Deir El Fakhuri (Lubell 1974) and one, K12 (Phillips 1973; Wendorf *et al.* 1997), some 3 km farther north. The Esna sites are within dune fields interfingering with Nilotic silts pertaining to early stages of the LPA (Wendorf and Schild 1976; Schild and Wendorf 1997). The dates from Wadi Kubbania suggest an age of about ≥ 24.5 to 23.3 cal ka BP, while the dates from the Esna area fall at *c.* 23.5 cal ka BP (SMU-1816), corrected on *Unio*, and 22.5 cal BP (SMU-2425), also on *Unio* (Schild and Wendorf 1997, 12).

The raw material economy is based on Eocene chert, both mined and recovered from wadi deposits, except for perhaps the oldest camp at Wadi Kubbania (Site E-81-3) where Nilotic chert and quartz predominate the indices. Technology is non-Levallois, utilizing opposed (Fig. 7.13, 2) and single platform cores (Fig. 7.13, 1) for blades,

bladelets and flakes, with a certain amount of changed orientation and globular varieties. Backed bladelets are a largely dominant tool group, including arch (Fig. 7.13, 10–12) and straight (Fig. 7.13, 8–9, 13–15) backed, pointed bladelets as well as some Ouchtata retouched pieces. These are followed by retouched pieces and perforators (Fig. 7.13, 6–7), with double-backed (Fig. 7.13, 3) and sometime double-pointed (Fig. 7.13, 4) specimens. Endscrapers are present (Fig. 7.13, 16), while truncations and burins are rare. The sites often exhibit recurrent occupations. A single, disturbed burial located within the camp area was found at Site E71K1, near the Deir El Fakhuri monastery.

The Kubbanian

Numerous Kubbanian sites in Wadi Kubbania occur in various palaeogeomorphic settings, within an early phase of development of the entire sequence. Here, 51 radiocarbon dates were obtained from various materials, mostly charcoal (Wendorf and Schild 1989a, 793). Except for clearly erratic ones, they range from *c.* 18 ka BP (21–20.8 cal ka BP) to 16.5 ka BP (20–19.3 cal ka BP). There are two Kubbanian sites near Edfu (E71P1, Areas C and D), of which one is dated to about 18 ka BP, and the other (E71K13), near Esna, is undated (Phillips 1973).

In the Wadi Kubbania sites, Nile chert was the preferred raw material. The use of Eocene chert increases with time and seems to be correlated to the appearance of Levallois and Halfa methods. The technology is composed of numerous opposed and single platform cores for bladelets (Fig. 7.14, 1–2) and flakes (Fig. 7.14, 5–6), with fewer changed orientation specimens (Fig. 7.14, 7). The Levallois (Fig. 7.14, 9) and Halfa cores seem to appear in later phases of the development and are always rare at Kubbania (Close 1989a; Więckowska 1989) and Isna (Phillips 1973, Fig. 31c, f), but numerous near Edfu (Wendorf and Schild 1976, 244). Backed bladelets, almost exclusively of Ouchtata variant (Fig. 7.14, 11–14), are nearly always dominant reaching up to over 80%, except for some of the late assemblages where scaled pieces (Fig. 7.15, 2–3) produce the highest indices and probably indicate a new activity (Wendorf and Schild 1989a, 794). Truncations (Fig. 7.14, 3–4), endscrapers and perforators are rare, while burins (Figs. 7.14, 10 and 7.15, 4) are fairly frequent. Of interest is the presence, at the base of the sequence at Kubbania, of bladelets with invasive retouch (Fig. 7.15, 1). In the latest sites, however, a notable frequency of arch-backed and pointed bladelets has been recorded, perhaps a precursor to the Qadan. In all respects, the Kubbanian closely resembles the Halfan and may be considered its Egyptian variant. Stylistic analyses by Close (1989b) suggest that the Kubbanian of Wadi Kubbania falls into two chronological groups. Variable grinding equipment is well represented in Wadi Kubbania (Roubet 1989a, 1989b), as well as an assortment of bone points (Fig. 7.15, 5–7, 11–16) and ostrich eggshells beads (Fig. 7.15,

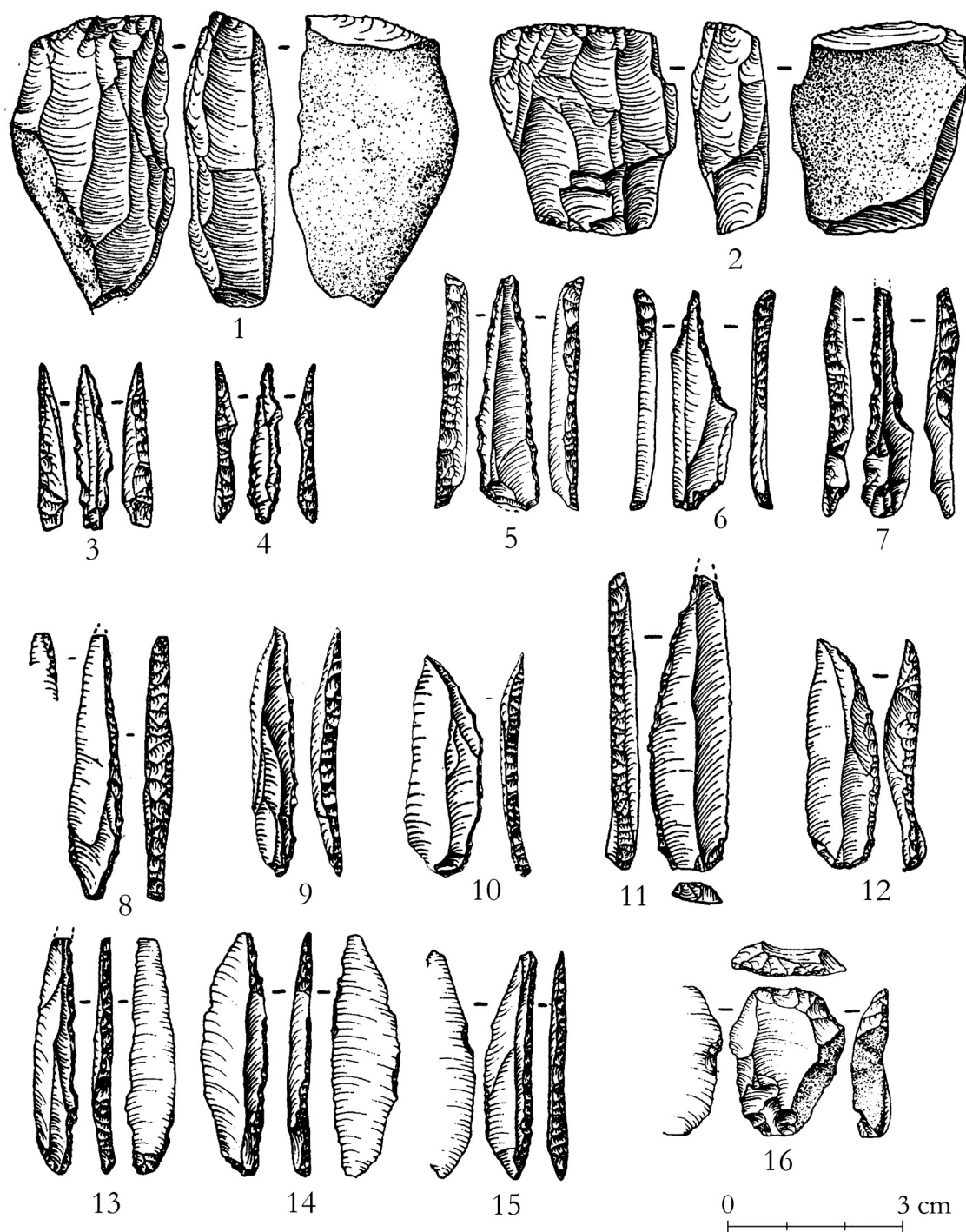


Figure 7.13. Fakhurian: Sites E71K3 (1–5, 11–12, 16), E71K5 (8–10), Deir El Fakhuri, and E71K12 (6–7, 13–15), Wadi n. 6, Esna area. 1: Single platform bladelet core; 2: Opposed platform bladelet core; 3–5: Double backed perforators; 6–7: Perforators; 8–9, 13–15: Straight backed bladelets; 10, 12: Arch-backed bladelets; 11: Arch-backed blade; 16: Endscraper.

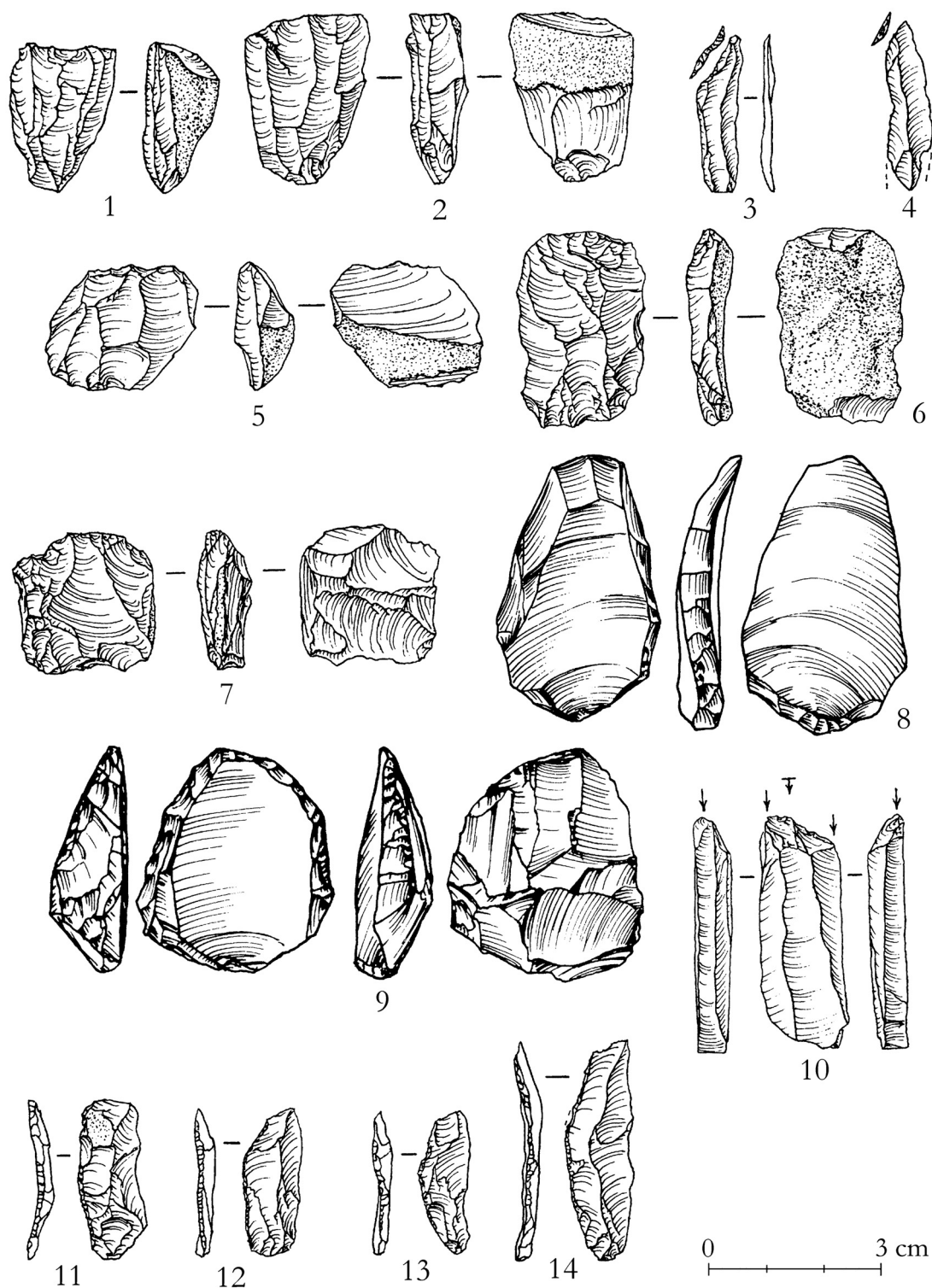


Figure 7.14. Kubbanian: Sites E-78-3 (1-2, 3-4, 5-7, 10-14) and E-78-4 (8-9), Wadi Kubbania. 1-2: Single platform cores; 3-4: Truncated bladelets; 5-6: Opposed platform cores; 7: Patterned multi-platform core; 8: Halfa flake; 9: Levallois core; 10: Burin; 11-14: Ouchtata pieces.

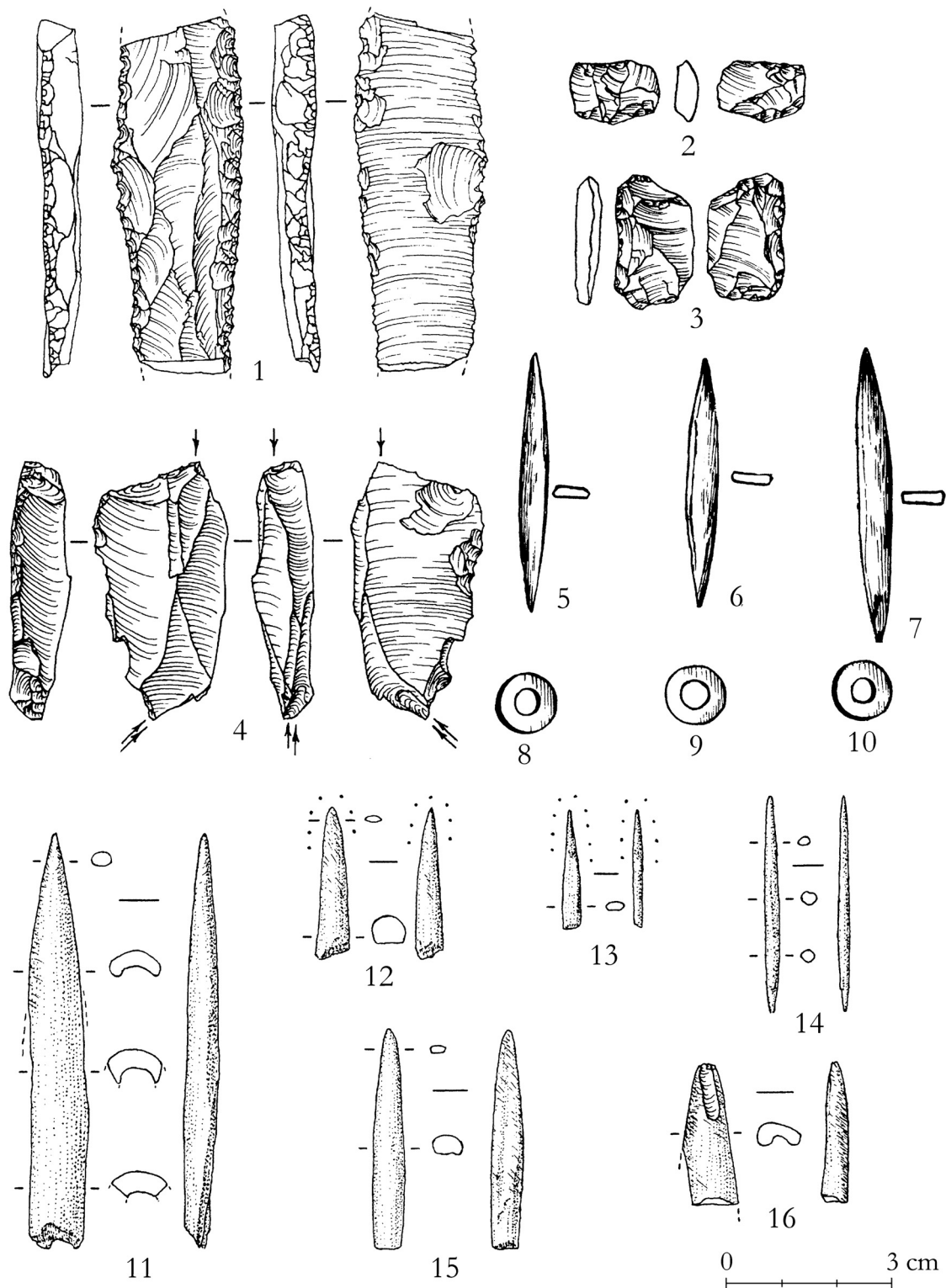


Figure 7.15. Kubbaniyan: Sites E-78-3 (1, 4, 11–16) and E-78-4 (2–3, 5–10), Wadi Kubbaniya. 1: Blade with continuous retouch; 2–3: Scaled pieces; 4: Multiple burin; 5–7: Bone points; 8–10: Ostrich eggshell beads; 11–16: Bone points, dots indicate use polish, note impact scar on n. 16.

8–10). The sites show repetitive occupations, spanning several centuries and/or a millennium, each of which represents a camping incident that leaves only minimal cultural debris.

The Idfuan-Shuwikhatian

The Idfuan/Shuwikhatian is known from four groups of sites near Edfu, Esna, Qena, and El Abadiya (Wendorf and Schild 1976; Vermeersch 2000). The Belgian authors' Shuwikhatian is very similar to non-Levallois variant of the Idfuan (see also Vermeersch *et al.* 2000d, 156). At Shuwikhat, near Qena, the Idfuan (Shuwikhatian) occurs in the Shuwikhat Formation silts that the present authors would like to correlate with an early phase of the Late Palaeolithic Alluviation (Schild and Wendorf 2004). A radiocarbon assay on burned bone from Shuwikhat yielded an age of about 16 ka BP, or about 19.3 cal ka BP. Classic TL dates on burned clay from Shuwikhat (Vermeersch *et al.* 2000d) place the Shuwikhatian at around 25,000±2,500 TL BP, or roughly around 20,500±2,500 radiocarbon years. At El Kilh, near Edfu (Sites E71P1A and B), the radiocarbon dates (uncorrected for fractionation and therefore minimal) fall between 17.6 and 17 ka BP (Wendorf and Schild 1976, 32), or about 20.8 to 20.1 cal ka BP. At Site E71K9, Esna area, an Idfuan, non-Levallois site produced a TL date (Wendorf *et al.* 1990, 401), on burned clay, of 21,590±1520 years (OxTL-161), overlapping within one Σ with the oldest dates for the El Kilh sites. Clearly, there is a problem. We cannot rule out that the Idfuan-Shuwikhatian is older than we think or that these units are only superficially similar.

The raw material economy of the Idfuan is characterized by a heavy use of Eocene chert, both mined and collected. The technology is based on well preformed opposed platform cores for blades, often with changed orientation. In the Levallois variant, both classic Levallois and Halfa cores occur. The IL index reaches nearly 15%. There are very few formal tools in the assemblages. Most of the tools are notches and denticulates (Fig. 7.16, 4), often converging, on blades (Fig. 7.16, 1–3) and flakes; retouched pieces and basal blunted ones (Fig. 7.16, 5) also occur, as well as some burins (Fig. 7.16, 6–7). Truncations and scaled pieces are present. The sites are usually thick, probably indicating repeated occupations.

The Afian

The first Afian sites were reported from six adjacent concentrations near the New Thomas Afia village in the Esna area (Wendorf and Schild 1976; Close *et al.* 1979). An important Afian site, Makhatma 4 near Qena, has been reported by Vermeersch *et al.* (2000b), and a small surface collection of Afian-like tools occurs in Wadi Kubbaniya (Close 1989c). The Afian has also been recorded at Site GS-2B-I on Gebel Silsila, Kom Ombo.

The Afian sites in the Esna area (Site E71K18) occur below the topmost silts of the Late Palaeolithic Alluviation

(Wendorf and Schild 1976, 78). A vast majority of the ^{14}C dates place the Afian before the final conclusion of this aggradation. At Makhatma 4, seven radiocarbon assays associated with an Afian midden (Van Neer *et al.* 2000) stretch from 12,940±130 BP (GrN-12034), or about 15.2 cal ka BP, to 12,320±100 BP (GrN-12981), or *c.* 14.2 cal ka BP. At Kom Ombo, Site GS-2B-I, three radiocarbon dates range from 13,560±120 BP (Stuiver 1969), on shell with no fractionation (Y-1447), or about 16.2 cal ka BP, to 13,240±130 BP, on shell, or *c.* 15.1 cal ka BP (Haas and Haynes 1975). Most of the dates overlap within one Σ . An educated guess places the Afian within *c.* 16.5 to 15–14.5 cal ka BP.

Eocene chert is the main source of raw material. In the New Thomas Afia assemblages, only collected wadi pebbles and small cobbles were used. Usually unprepared (except for the platform) single (Fig. 7.17, 2) and opposed platform (Fig. 7.17, 1) cores for bladelets and flakes are the most common. As a rule, they are accompanied by changed orientation specimens. Atypical Levallois cores occur occasionally, as well as peculiar bent (Fig. 7.18, 1–2) Levallois cores (Schild 1971). Atypical geometric microliths, trapezoids and triangles (Fig. 7.18, 7–9, 11–14), truncated bladelets and flakes (Fig. 7.18, 15–18), backed pieces (Fig. 7.18, 5–6), backed and truncated bladelets and microburins (Fig. 7.18, 10), including specific central pressure microburins (Fig. 7.18, 19–20), comprise most of the assemblage. Perforators and burins (Fig. 7.17, 5–6) are usually rare, and endscrapers (Fig. 7.17, 3–4) exhibit extremely variable frequencies (Close *et al.* 1979). The Makhatma 4 assemblages differ from the New Thomas Afia collections by including numerous burins, arch-backed pieces, backed bladelets, trapezes, and triangles as well as by a lack of Levallois pieces and microburins. Bipointed bone artefacts, probably fish gorges (?), accompany the rich lithic assemblages of Makhatma 4. The powdery sediment, abundant in charcoal, in which the cultural debris of Makhatma was embedded, as well as numerous pits, postholes and plentiful fish remains suggest that the smoking of fish was an important activity of the Makhatma camp dwellers (Van Neer *et al.* 2000; Vermeersch *et al.* 2000b). The Kom Ombo sites, on the other hand, included several hundred grinding stones, which are not present at New Thomas Afia.

The Isnan

The Isnan is the youngest Late Palaeolithic entity found in Egypt. Several Isnan sites occur throughout Egyptian Nubia and Upper Egypt, from Wadi Kubbaniya (Wendorf and Schild 1989b), through the Esna, Nagada (Wendorf and Schild 1976), Abadiya, near Nagada, and Makhatma areas (Vermeersch *et al.* 2000c) up to the Dishna plain, west of Qena (Hassan 1974; Wendorf and Schild 1976; Kabaciński and Usai 1999). The Isnan sites seem to be coeval with the latest silts of the LPA. At Kubbaniya, the Isnan materials occur with the highest level of the dam lake deposited at the

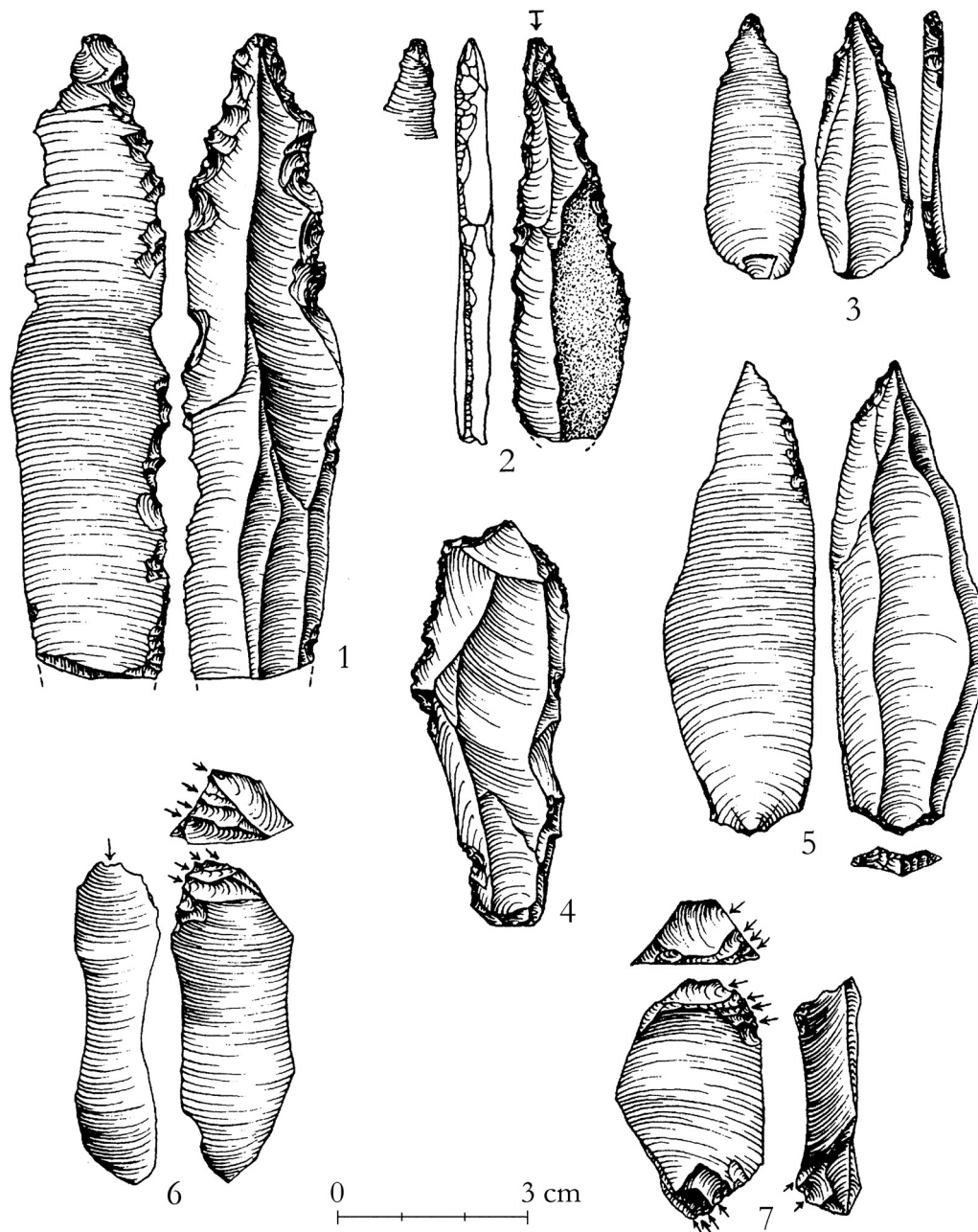


Figure 7.16. Idfu: Site E71K9C, Village 4, Esna area. 1–3: Converging denticulated blade/perforator; 4: Denticulated blade; 5: Truncated blade with basal blunting; 6–7: Burins.

beginning of the down-cutting (Wendorf and Schild 1989b). At Site E71P5, in the El Kilh area, the Isnan occupation is in the down-cutting channel cut into the aggradational silts and sands of the LPA (Wendorf and Schild 1976, 35). The Isnan site in Wadi Kubbania is dated $12,430 \pm 100$ (SMU-1032), on *Unio* shell, or *c.* 14.5 cal ka BP. At Makhatma 2, charcoal from hearths most likely associated with the Isnan

occupation (Vermeersch *et al.* 2000c) is dated $12,270 \pm 100$ (GrN-12030) BP, or *c.* 14.1 cal ka BP and $12,060 \pm 280$ (GrN-12029), or about 13.9 cal ka BP. In short, all these ages suggest early Bølling, the latest phase of the LPA and the beginning of the subsequent down-cutting.

The Isnan lithic raw material economy is based on rather large Eocene chert slabs and nodules. Hard hammer

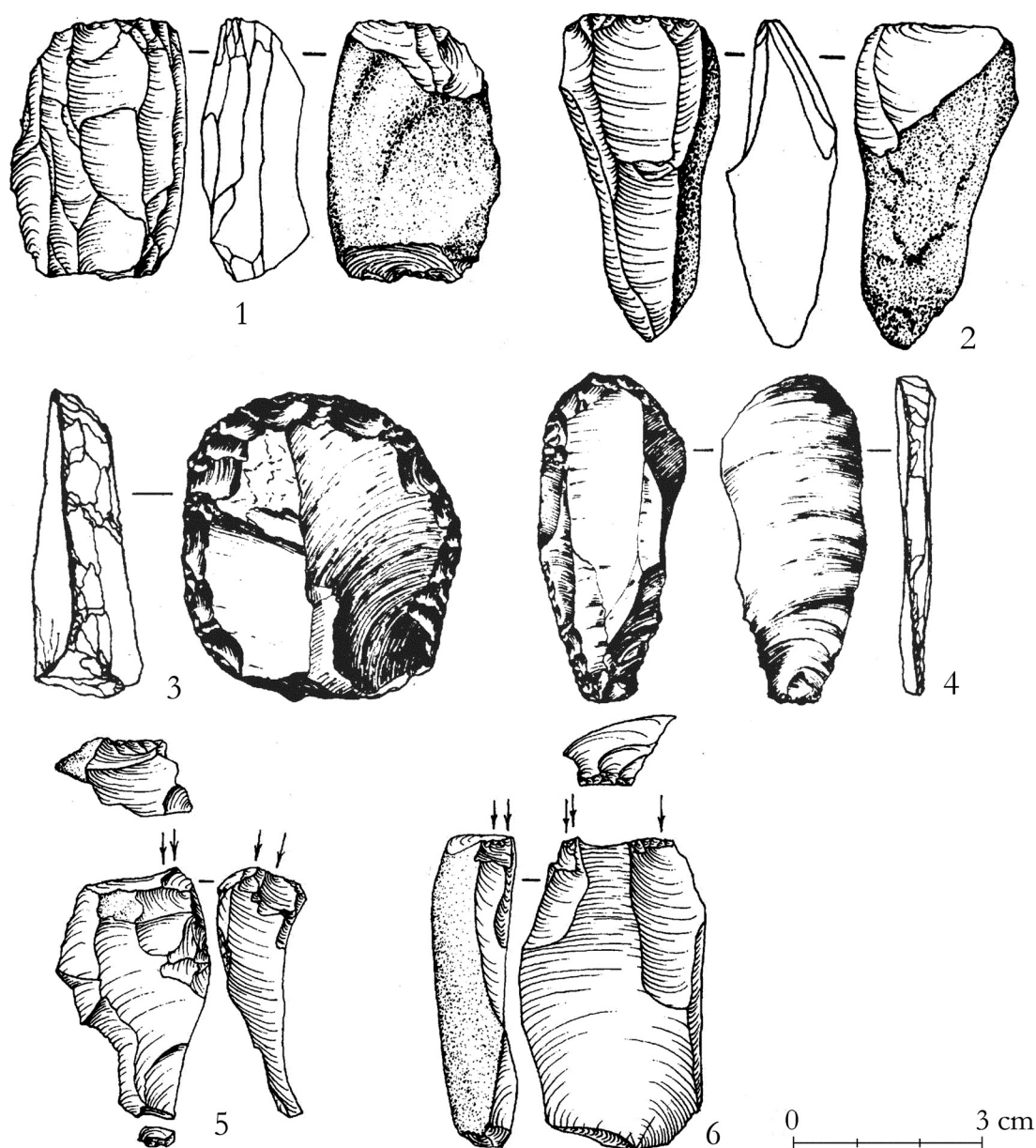


Figure 7.17. Afian: Site E71K18 (1–2, 5–6) and E71K6B (3–4), Thomas-Afia Village, Esna area. 1: Opposed platform bladelet core; 2: Single platform bladelet core; 3–4: Endscrapers; 5–6: Burins.

percussion technique was performed on changed orientation globular, and single and opposed platform cores for flakes. Blade cores are rare. The main feature of many assemblages is a very high percentage of endscrapers (Fig. 7.19, 1–2). Notches and denticulates are second in number, while burins are rather rare (Fig. 7.19, 3–4). Backed elements are usually rare (Fig. 7.19, 5), except for some sites, and include

elongated rectangular backed and truncated bladelets (Fig. 7.19, 11–14), as well as occasional arch-backed pieces. Truncations are rare (Fig. 7.19, 10), sometimes double, or trapezoidal (Fig. 7.19, 6–9). The Dishna sites (Hassan 1974) are peculiar and seem to be oriented toward workshop activities associated with flint quarrying in nearby exposures. Here, denticulates and notches as well as retouched pieces

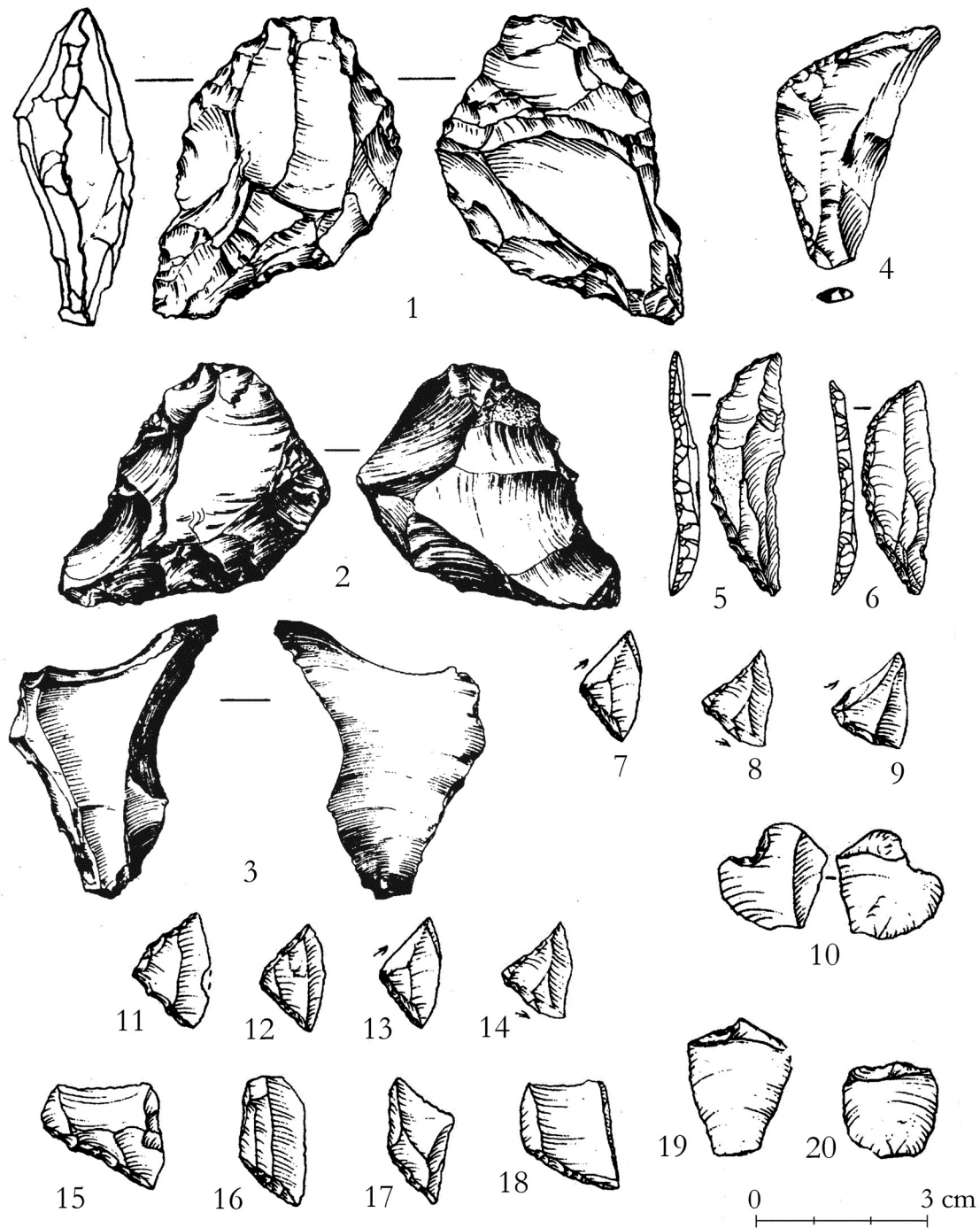


Figure 7.18. Afian: Site E71K18 (5–6) and E71K6B (1–4, 7–20), Thomas-Afia Village, Esna area. 1–2: Bent Levallois cores; 3: Flake from a bent Levallois core; 4: Backed sickle-flake from a bent Levallois core; 5–6: Fully arch-backed blades; 7–9, 11–14: Isosceles triangles, 7–9 and 13–14: with microburin scars; 10: Simple microburin; 15–18: Basally truncated bladelets and flakes; 19–20: Central pressure microburins.

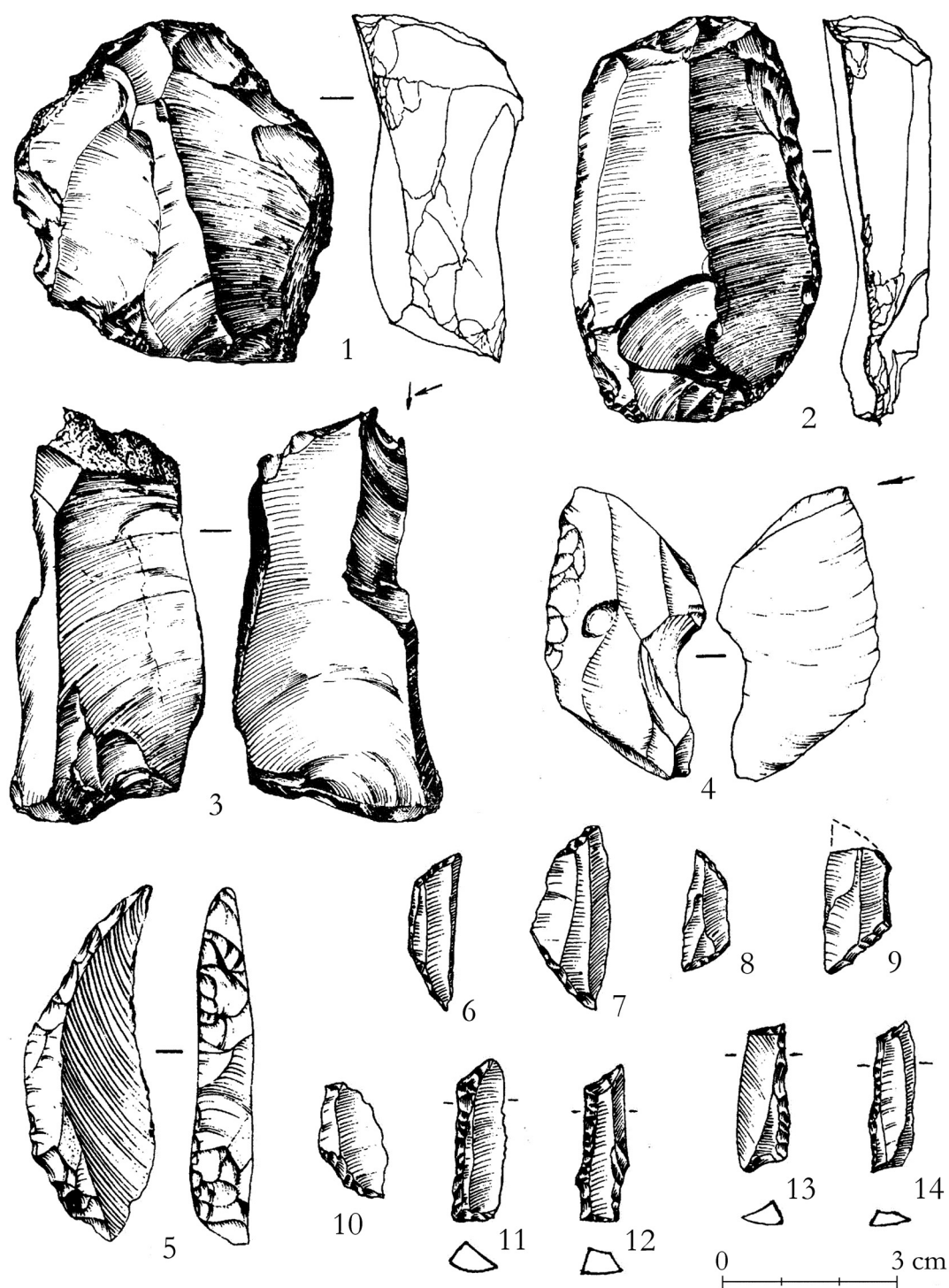


Figure 7.19. Isnan: Sites E71K14, Area D (1–3), E71K15 (4–5), Wadi n. 6, and E71K22 (6–14), Deir El Fakhuri, Esna area. 1–2: Endscrapers on flakes; 3–4: Burins; 5: Arch-backed flake; 6–9: Trapezoids; 10: Basally truncated flake; 11–14: Elongated backed rectangles.

reach their highest indices (Hassan 1974; Wendorf and Schild 1976; Kabaciński and Usai 1999). Grinding implements are present at several Isnan sites.

Adapting to the desolate valley

For many decades scholars tried to define a specific Nilotic adaptation of the cultural variants present in the main Nile Valley. Today, when our knowledge about the LP environments and their exploitation is much more complete than before, we know that past populations, trapped as they were in the valley, made use of everything available: fish, shellfish, mammals, and plant foods. Exploitation of these resources was quite seasonal and occurred when the Nile temporarily opened particular niches. The sites were repetitively and seasonally used throughout centuries, if not millennia, by relatively small communities, perhaps nuclear families, as long as a particular ecological niche did not change or disappear (Fig. 7.20).

This wide mosaic of cultural responses to an unchanging Nilotic environment during the Late Palaeolithic settlement of Nubia and Upper Egypt always troubled the students of that period (compare Wendorf 1968a; Wendorf and Schild 1976, 1989a). Yet, certain patterns seem to be obvious. Both the Gemaian and Qadan are not present in Upper Egypt, while the Fakhurian, Idfuan/Shuwikhatian, Afian and Isnan entities are not known beyond the First Cataract. This pattern may suggest cultural affinities with larger, central African traditions in the case of the former entities, and with Mediterranean traditions in the case of the latter ones. Indeed, a number of common technological elements links the Iberomaurusian of the Maghreb with the Fakhurian and, to a lesser extent, with the Kubbanian, etc. (Phillips 1973; Kozłowski 2008). Questions become even more puzzling if we adopt the very plausible hypothesis of Kozłowski (2008, 190) linking the beginning of the Iberomaurusian in the Maghreb with the Iberian Gravettian.

People at war

The people in the valley shared many common physical traits, suggesting basically the same population. According to Thoma (1984), the Nazlet Khater man is a thick-jawed modern human resembling somewhat later Nubian populations of Jebel Sahaba, Wadi Halfa and Wadi Kubbania (Anderson 1968; Greene and Armelagos 1972; Angel and Kelley 1986; Wendorf and Schild 1986; Dutour 1995; Irish 2000). They all have “prominent brow ridges, low rectangular orbits, projecting zygomatic arches, alveolar prognathism, large facial foramina, low broad mandibular rami, gonial eversion, and large complex teeth.” (Irish 2000, 395). Human movement and the spread of an information network was hampered in the valley, which was congested to such an extent that only war and physical disposal of competitors could make more room for newborns. Clearly,

the way out of the valley was only via death. And indeed there was a lot of war from the very beginning of the Late Palaeolithic in the valley. The oldest of all the LP interments, a single burial of a young man at the base of the LP sequence in Wadi Kubbania, demonstrates again that Palaeolithic life in the Nile Valley around 25 ka ago was not entirely rosy. The young man from Wadi Kubbania had a healed parry-fracture sustained at about age 15 and a recently healed left humerus wound with an embedded stone chip. He was killed in his early twenties by a spear in the back (Angel and Kelley 1986, 70; Wendorf and Schild 1986). Two flint bladelets were found in his abdominal cavity.

At the Qadan graveyard of Gebel Sahaba (Anderson 1968; Wendorf 1968c) it was even worse. Here, at around 16.5 cal ka BP, the entire community was probably exposed to sustained, vicious, long-term warfare. The burials at Gebel Sahaba, with interments sometimes of four (Fig. 7.21) to eight individuals of all ages and sexes and with multiple wounds indicate organized conflicts intended to cause the greatest number of mortal casualties upon the competitor (Wendorf and Schild 2003, 2004). Lithic chips embedded in human bones and the presence of cut-marks are clear evidence of violence. This is also demonstrated by a noticeable frequency of forearm injuries that resulted from fending off blows; they occurred in nearly 11% of all the individuals. These, however, are not more frequent than in later cemeteries in the Sudanese Nile Valley (Judd 2006, 162). Also, the latest study of the Gebel Sahaba collection suggests that the community buried there, in spite of evident violence and aggression, was not undernourished or impoverished and was much better off than some of the younger Nilotic societies such as the later Badarian and Dynastic ones (Judd 2006, 160).

The North-Eastern African cattle domestication

By the end of the Late Palaeolithic and at the turn of the Pleistocene something extremely important must have happened in the valley, the first human taming of *Bos primigenius*, the aurochs. We believe that the cattle remains that accompany El Adam people, the descendants of the Arkinians (Fig. 7.22), in the Nubian Desert at c. 11.5–11 cal ka BP represent a domesticated or at least tamed aurochs. Achilles Gautier, who studied all the early *Bos* remains from the south Western Desert, is of the opinion that some of the measurements of the desert cattle are similar to those of the smallest individuals found in the Nile Valley. However, most are still smaller and close to the upper range of the south German, La Tène cattle of Manching type (Gautier 1980, 332). The very low carrying capacity of the south Western Desert in the early Holocene, as indicated by the accompanying fauna and climatic evidence, prohibited the survival of *Bos primigenius* without human help, particularly in

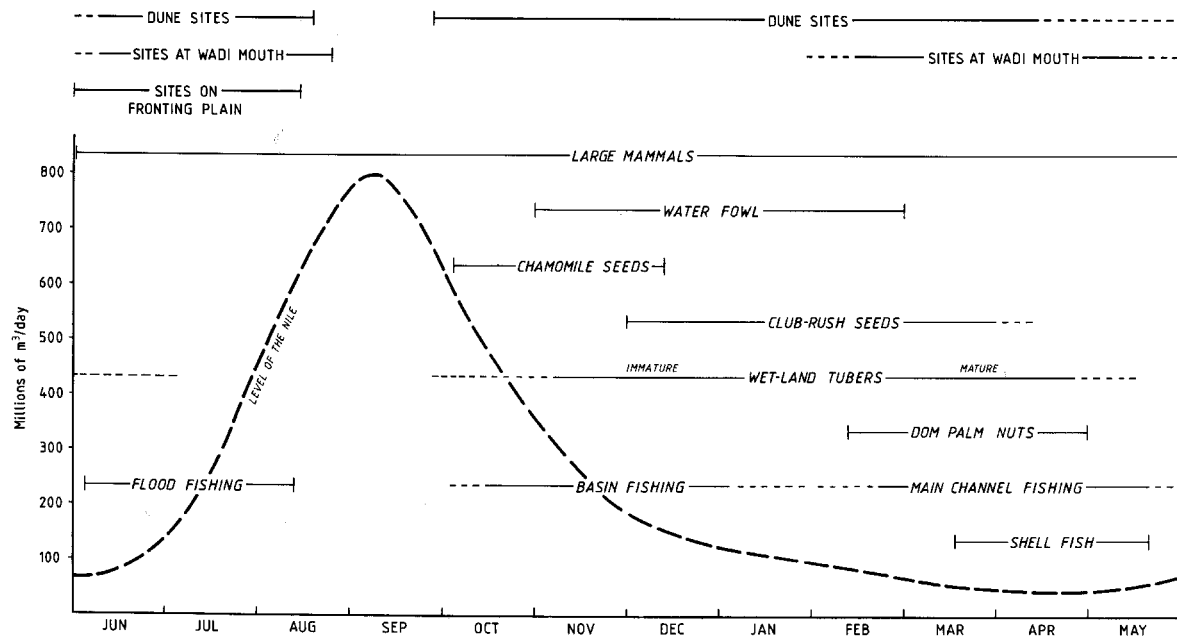


Figure 7.20. Subsistence cycle and niches at Wadi Kubbaniya between c. 21 and 19.3 cal ka BP.

watering the animals (Gautier 1980, 332, 1990, 229). Charcoal samples from the El Adam occupations contain *Tamarix* as the only wood species, indicating very harsh climatic conditions, similar to those described from modern small oases of the south Western Desert of Egypt (Barakat 2001, 596). Neumann (1993), on the other hand, believes that the very contracted vegetation in the early Holocene of the Western Desert made large scale cattle keeping impossible. Examination of several well-preserved *Bos* bones recovered from a number of early Holocene sites in the Bir Kiseiba area of the southern Western Desert of Egypt convinced Gautier (1984, 61) that these remains cannot be identified with an extinct form of *Bos*, i.e. *Pelorovis antiquus*, and/or the modern African buffalo. Several authors have rejected Gautier's ecological and biological arguments and postulate that the bones found in the southern Western Desert might have belonged to the small Cape buffalo or be intrusive (Smith 1984, 1986, 1992, 2005; Clutton-Brock 1989, 1993; Muzzolini 1993). Gautier (1987b) challenged these arguments by attributing the smaller size of the Saharan cattle, in comparison to the later breeds found in the Fayum and the Nile Valley, to poor grazing and ecological stress in the Saharan environment.

We have tried to further elaborate Gautier's ecological argument by pointing out that faunal assemblages consisting only of small and – rarely – medium sized, desert adapted animals together with relatively large wild cattle have never been reported from pre-Neolithic Africa (Wendorf *et al.* 1987; Wendorf and Schild 1994, 2001). Such assemblages,

however, exist in the Sahelian belt, where domesticated cattle are found. It is of great importance to remember that the constant Late Pleistocene Nilotic duo of *Bos primigenius* and hartebeest does not exist in the eastern Sahara, where it has been reduced to cattle and small and medium-sized gazelles and/or antelopes. However, the hartebeest is known to tolerate greater aridity than cattle (Kingdon 1982). Our most recent studies of the palaeoenvironments of the southern Western Desert of Egypt strongly indicate that neither wild cattle nor the African buffalo, could survive in these climates without permanent water, which was present only during the rainy season. So far, all the early Neolithic El Adam camps that have yielded cattle bones are located in the centres of basins that held no water during occupations (Wendorf and Schild 2001, 656).

Two new crucial arguments recently entered the discussion of African cattle domestication: DNA studies and linguistics. The mtDNA analyses of modern cattle strongly suggest that extant Eurasian and African cattle populations separated around 25 ka ago (Bradley *et al.* 1996); we think most probably during the Last Glacial Maximum and associated hyperaridity of the Sinai peninsula, which caused the division of the two populations. The mtDNA evidence indicates that domestication in Africa occurred earlier than in Asia (Hanotte *et al.* 2002), perhaps well before 9000 years ago (Bradley *et al.* 1996). It is very likely that expansion of the African cattle began from a single region of origin (MacHugh *et al.* 1997; Hanotte *et al.* 2002). Furthermore, the genetic distance separating the ancient



Figure 7.21. Site 117, Gebel Sahaba, Burials 26 and 32. Two members of a group of four.

African cattle from the ancient Near Eastern breeds is nearly three times larger than that between the latter and the ancient, Neolithic European strains, as the DNA analysis of 101 ancient cattle remains, dating between 1000 and 9000 years BP, has indicated (compare Edwards *et al.* 2004, Fig. 2). The genetic information clearly supports a hypothesis of independent early domestication of African cattle (compare Beja-Pereira *et al.* 2006, 8116).

As for the linguistics (Ehret 1993; 2001), a detailed scrutiny of Nilo-Saharan root words points to the very early appearance of words linked to cattle pastoralism, followed later by words associated with the cultivation of Sudanese crops (Ehret 2006). Using known historical changes in these languages as a measuring stick, Ehret estimates that the

words related to pastoralism originated before 8500 BC, and that those related to the cultivation of sorghum appeared somewhat later, but still before about 9000 years ago, both in the eastern Sahara and the eastern Sahara belt (Ehret 2006, 1044). Ehret's chronology closely fits the appearance of cattle and the first sorghum cultivation in the Neolithic of the southern Western Desert of Egypt (compare Wendorf and Schild 1994, 2001).

Continuing this discussion, we wish to remind the tolerant reader of this treatise that the main Nile Valley was the only place in Africa where humans and cattle developed a very close relationship, particularly during the times of high Nile floods, when both had to exist in a very narrow belt of almost inhabitable land. This close relationship is

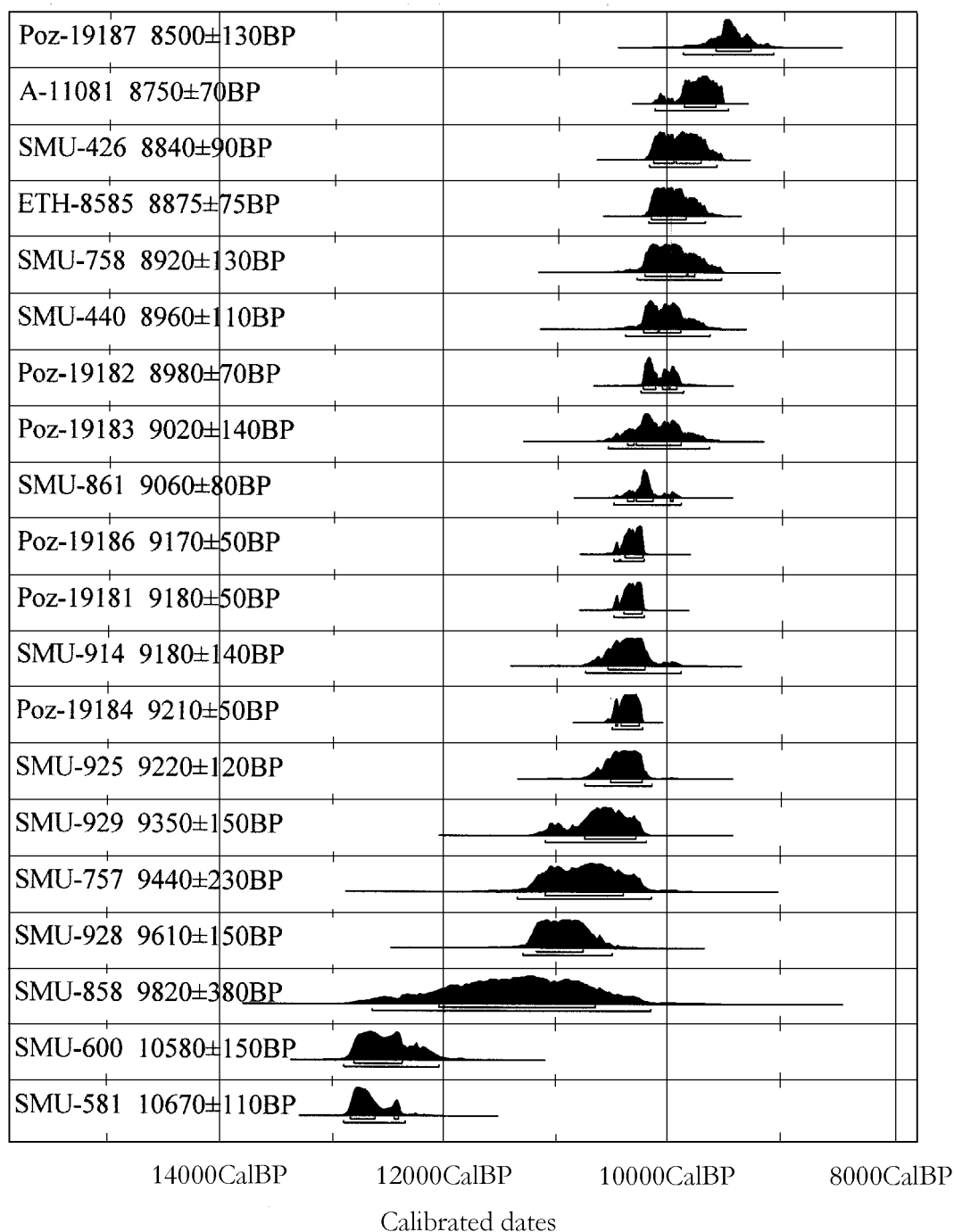


Figure 7.22. Chronological relationship of the Arkinian (SMU-581 and SMU-600) and the El Adam settlers of the South Western Desert. Calibration according to OxCal, v3.10 (Bronk-Ramsey 2001).

certainly manifested in the Qadan bucranial grave head-markers of Tushka (Wendorf 1968b, 875). And we need to reiterate two important observations made by our old friend, Achilles Gautier, concerning *Bos* sizes in the Nile Valley, particularly during the upper Late Palaeolithic. He found

that the cattle in the Qadan and the Arkinian cluster in two size groups, one containing large individuals, which he then considered to be bulls, and the other with smaller cows. Later work at the Fakhurian site of E71K12, near Esna, revealed the remains of an unusually large *Bos*, bigger than

previously reported “males” (Gautier 1993; Baker and Gautier 1997). These observations prompted Gautier to suggest that the larger individuals from the Qadan and Arkinian are, in fact, females and, therefore, the smaller ones may have been cattle in an early stage of domestication (Gautier 1993). Later, Gautier moved away from this hypothesis (Gautier 2001). We, nevertheless, still find it very attractive. Only the identification of chromosomes in the collagen DNA of the large individuals from the Qadan and Arkinian sites will falsify the latest Gautier’s stand. Finally, if indeed the first domestication of cattle took place in north-eastern Africa, it happened in the Nile Valley, before people moved into the south Western Desert. It was cattle, their movable larder, that permitted the Arkinians to colonize the eastern Sahara.

Parting words

We hope that those readers who reached this point in our essay will pause to reminiscence about this unusual story of human adaptation to an environment that has disappeared from the surface of the Earth. It is not a happy chronicle, for it is a story of violence, misery and aggression. We do not know how and why the populations and modes of tool production were replacing each other during the Late Palaeolithic. We believe that some, like the Sebilian, seem to be expressions of ethnic intrusions into the valley from southerly lands at a time when the Nile Valley became more hospitable and when the enriched plant life of the Bølling warm pulsation made a bridge between equatorial Africa and the main Nile Valley. Others may have resulted from suddenly or gradually changing modes of tool making within the same social units. Unfortunately, we will not learn very much more from fieldwork in the Nile Valley, where the ever increasing reclamation of land due to mounting demographic pressure, has destroyed nearly all the Late Palaeolithic sites. A few are still there, but their days are numbered.

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Neanderthals and Early *Homo sapiens* in the Levant

John J. Shea

Introduction

The nature of Neanderthals' relationship to early *Homo sapiens* is one of the longest-running and controversial debates in palaeoanthropology. During the Middle Palaeolithic (MP) period in the East Mediterranean Levant, c. 250–45 ka BP, early representative of our species, *Homo sapiens*, first dispersed into western Eurasia, a region already occupied by Neanderthals (*Homo neanderthalensis*). Neanderthals were cold-adapted populations who evolved in western Eurasia before 200 ka BP (Hublin 1998). The oldest-known *Homo sapiens* fossils are found in African contexts dating to 200–150 ka BP (Trinkaus 2005). Neanderthals became extinct shortly after *Homo sapiens* populations expanded into Europe between 40–30 ka BP (Mellars 2006a). For much of the time that Neanderthals existed, the East Mediterranean Levant was a biogeographic corridor linking Africa to south-west Asia. The Levant is where Neanderthals and *Homo sapiens* are likely to have first encountered each other, and it is there that we must look for clues to these species' divergent evolutionary fates.

(Note: This paper does not use the terms “modern human” or “modern human behaviour” because they are so imprecisely and variably defined that they no longer have descriptive value in human origins research.)

Background

The East Mediterranean Levant encompasses the modern states of Lebanon, Syria, Israel, Jordan, and adjacent parts of Egypt (the Sinai peninsula) and southern Turkey (Fig. 8.1). Ecologically, this region is unified by the predominance of Mediterranean-type vegetation and associated fauna (Blondel and Aronson 1999). The modern climate features hot dry summers and cool wet winters. Pollen recovered from lacustrine and marine sediment cores and isotopic geochemistry of speleothems preserve evidence for recurring

humid episodes that allowed woodland biota to extend their ranges well into areas that are now desert (Cheddadi and Rossignol-Strick 1995; Bar-Matthews *et al.* 2000a; Almogi-Labin *et al.* 2004).

Palaeolithic archaeological research in the Levant began in the early 20th century. Following a war-related interruption at mid-century, fieldwork resumed and increased throughout the region in the 1960s–1980s. One of the most important developments in research on the MP period was the application of thermoluminescence (TL), electron spin resonance (ESR) and uranium-series (US) dating methods in the mid-1980s onwards. In the Levant, the MP is largely beyond the effective range of radiocarbon dating. TL, ESR, and US dating allowed chronological relationships among MP sites to be assessed independently of prevailing models of human cultural and biological evolution.

The application of these new dating techniques considerably lengthened the known duration of the MP, from 100–40 ka BP to 250–45 ka BP (Shea 2003a). They also refuted a longstanding hypothesis of a Neanderthal to *Homo sapiens* evolutionary transition in the Near East (McCown and Keith 1939; Howell 1958; Binford 1968; Jelinek 1982; Trinkaus 1984). Contrary to the expectations of this hypothesis, early *Homo sapiens* fossils from Skhul and Qafzeh were shown to be tens of thousands of years older than their putative Neanderthal ancestors. Instead, during the MP period the Levant experienced a complex alternation of Neanderthal and *Homo sapiens* occupations. Scientific explanations of this alternating pattern in the hominin fossil record to fall into two major categories, “continuity” arguments and “replacement” hypotheses.

Continuity arguments view Neanderthals and early *Homo sapiens* as part of a single evolving hominin population (Simmons 1999; Kramer *et al.* 2001; Hovers 2006). The pattern in the chronostratigraphic distribution of Neanderthal and *Homo sapiens* fossils is seen largely as an artefact of typological approaches to hominin fossils species and of sample error. Unlike earlier continuity hypotheses (cited

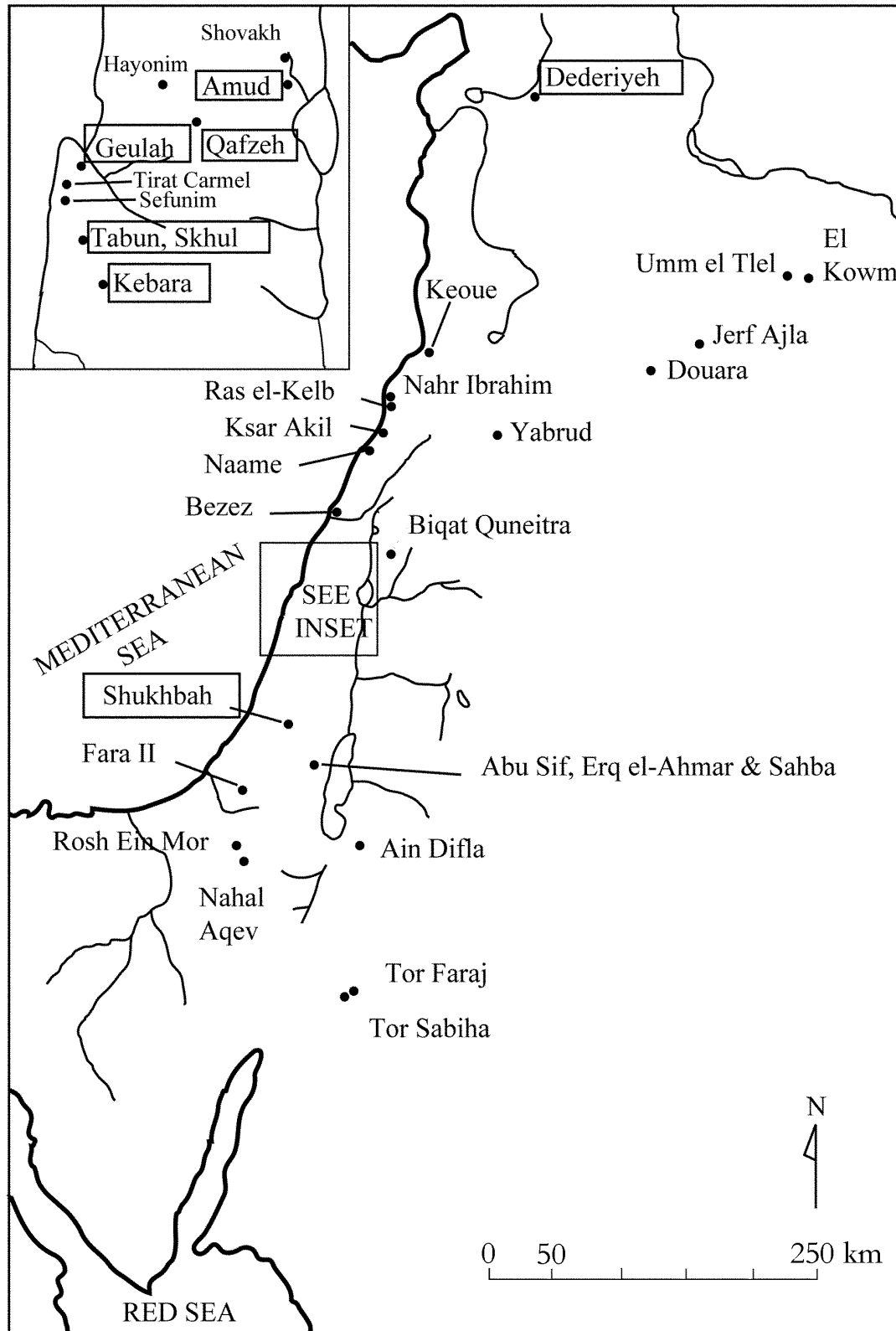


Figure 8.1. Map showing key Levantine Middle Paleolithic sites. Site names enclosed in boxes are those from which morphologically-diagnostic hominin fossils have been recovered.

above), these recent continuity arguments do not make specific predictions about chronostratigraphy that allow a decisive refutation of their core argument.

Replacement hypotheses view Neanderthals and early *Homo sapiens* as separate entities occupying essentially identical ecological niches (Rak 1993; Henry 1995; Shea 2003b, 2007a, 2008). For the proponents of these hypotheses, the chronostratigraphic pattern in the hominin fossil record is an actual reflection of evolutionary processes. The mechanisms of replacement and nature of Neanderthal-*Homo sapiens* interactions (if any) differ among these hypotheses, but all share the same core prediction: that there was no prolonged face-to-face contemporaneity between Neanderthals and *Homo sapiens*. Only replacement hypotheses are actually “hypotheses” in the positivist scientific sense – that they can be proven wrong (Shea 2008).

Time, stone tools, and hominin fossils: descriptive frameworks

Table 8.1 presents a synthetic framework for the Levantine MP and Initial Upper Palaeolithic correlating changes in climate, stone tool industry, and the hominin fossil record.

Geochronological framework

Palaeolithic archaeologists increasingly organize their chronological frameworks for the Middle and Late Pleistocene in terms of marine oxygen-isotope stages (MIS). The MIS record is a continuous record of global climate change reconstructed from variation of oxygen isotopes ($\delta^{18}\text{O}$) in marine sediment cores (and increasingly polar ice cores as well). Variation in $\delta^{18}\text{O}$ values monitors changes in polar and glacial ice volume. For convenience, the continuous MIS record is divided at major transitions into a series of stages of varying duration. Odd-numbered stages reflect relatively warm conditions with high sea levels and low glacial ice volume. Even-numbered stages reflect colder, “glacial” conditions. We are now living in MIS 1 (<12.5 ka BP, or the Holocene epoch).

Most radiometrically dated Levantine MP contexts are from MIS 5 through early MIS 3, or roughly 130–45 ka BP. Compared to the Holocene, this was a period of extraordinarily frequent climate changes, an “Age of Chaos” (Burroughs 2005). Regional effects of the global changes in the MIS record can be inferred by correlating pollen and the $\delta^{18}\text{O}$ values of sediments cored in the Mediterranean and from isotopic analysis of speleothems in karst caves, such as Soreq Cave in Israel (Bar-Matthews *et al.* 2000b; Almogi-Labin *et al.* 2004). These records show wide-ranging and short-term variation in temperature and rainfall for much of the Late Pleistocene. Peak dry conditions along the Mediterranean coast had estimated annual rainfall of 200–300 mm/year (roughly half than at present) and low

annual average temperatures of 12–14°C (vs. 18–22°C of today) (Bar-Matthews and Ayalon 2003, 18; McGarry *et al.* 2004). Such wide-ranging and short-term palaeoclimatic variability almost certainly had an adverse effect on Levantine hominin population size, stability, and evolutionary continuity (Bar-Yosef 1988; Shea and Bar-Yosef 2005; Shea 2008).

Hominin fossils

Hominin fossils from the Levantine MP are usually described in terms of two taxa, early *Homo sapiens* and *Homo neanderthalensis*, or “Neanderthals” (Fig. 8.2). This taxonomy implies species-level differences, but the evolutionary relationships between these fossils are far from clear. Morphological characters that easily differentiate European Neanderthals and *Homo sapiens* do not similarly differentiate their Levantine MP counterparts (Kramer *et al.* 2001). Contrasts in Neanderthal and early *Homo sapiens* postcranial skeletal morphologies suggest differences in the habitual modes of movement and object manipulation as well as adaptations to different temperature regimes (Holliday 2000). Yet behavioural differences thus far identified from archaeological evidence scale within the range of differences observed among recent human hunter-gatherers (Lieberman and Shea 1994).

The sequence of hominin fossils in the Levant MP follows no clear chronological progression (at least as of early 2009). The most recent dating evidence suggests the Tabun C1 Neanderthal and the early *Homo sapiens* fossils from Skhul are broadly contemporaneous, dating to 130–100 ka BP (Grün *et al.* 2005). The *Homo sapiens* fossils from Qafzeh may be younger, *c.* 100–90 ka BP. Neanderthal remains from Tabun B, Kebara IX–XII, Geula and Amud B date to between 75–50 ka BP. Although there is some overlap among the dates for these fossil contexts (because many TL, ESR, and U-Series dates have standard deviations of thousands or even tens of thousands of years), Neanderthals and early *Homo sapiens* fossils do not occur together in the same level of any archaeological site. Given the immense spans of time involved and the region’s small size, Neanderthals and *Homo sapiens* probably encountered one another many times, but there is no evidence for prolonged sympatry (chronological and geographic overlap).

Stone tool industries

The cultural stratigraphy of the MP is defined in terms of variation in stone tool technology. Most Levantine MP stone tool assemblages are grouped together into a single “Levantine Mousterian” industry (Fig. 8.3). Levantine Mousterian assemblages’ most distinctive attribute is the use of recurrent Levallois core-reduction strategies to product triangular and subtriangular flakes. Compared to European Mousterian assemblages, Levantine Mousterian

Cultural Period	Dates (ka BP)	MIS and Inferred Climate	Archaeological Complexes	Exemplary Dated Archaeological Contexts	Hominins
Upper Palaeolithic	38/36–25	MIS 3–2 Colder and drier	Early Ahmarian	Ksar Akil, VIII–XVII Kebara, Units III–IV Qafzeh, E/D (8–9) Boker, A Abu Noshra	<i>Homo sapiens</i> Ksar Akil 1 Qafzeh 1–2
	47/45–40/38	MIS 3 Overall cold, but with wide short-term variation between drier and humid conditions	Initial Upper Paleolithic	Üçagizli, Locus II Level H Umm el Tlel, Unit III 2a–b Ksar Akil, Levels XXV–XVI Kebara, Units III–VI Boker Tachtit, Levels 1–4	Unknown
Middle Palaeolithic	71–47/45	MIS 4–3 Rapid onset of cold dry conditions	Phase 3 Later Mousterian	Tabun, Level B/Unit I Kebara, Units VI–XIII Amud, Level B Tor Faraj, Level C Biqat Quneitra	Neanderthals Tabun B dental remains Amud 1–7 Kebara 1–2 Geula Dederiyeh? Shukhbah?
	130–71	MIS 5 Warm, humid conditions followed by increasing cold and arid conditions	Phase 2 Mousterian	Tabun, Level C/Unit I Beds 18–26 Skhul, Level B Qafzeh, Units XVII–XXIV Naamé Douara Cave, Level III	Early <i>Homo sapiens</i> Skhul 1–IX Qafzeh 3–11 Early Neanderthals Tabun C1 <i>Homo</i> sp. indet. Tabun C2
	250–130	MIS 7–6 Warm, humid conditions (MIS 7) followed by colder, drier conditions (MIS 6)	Phase 1 Early Mousterian	Tabun Cave, Level D/Units II–IX Rosh Ein Mor 'Ain Difla Hayonim Cave, lower Level E	<i>Homo</i> sp. indet. Fragmentary remains from Hayonim E?
Late Lower Palaeolithic	350–250	MIS 8–7 Cold dry conditions (MIS 8) followed by warm, humid conditions (MIS 7)	Acheulo-Yabrudian	Yabrud Shelter 1, Levels 11–25 Tabun Cave, Level Ea/Units X–XII Bezez Cave, Level C Zuttiyeh Cave Qesem Cave	<i>Homo</i> sp. indet. Zuttiyeh 1 Fragmentary remains from Tabun Ea

Table 8.1. Levantine late Middle Pleistocene and early Upper Pleistocene cultural stratigraphy.

ones have high proportions of Levallois debitage and relatively few heavily retouched scrapers. They do not feature either bifacial core-tools (*i.e.*, “handaxes”) or foliate bifacial points like those in MP assemblages from eastern Europe, montane western Asia, or north-east Africa (the Nile Valley and the Horn of Africa).

The Levantine Mousterian is divided into three chronological “phases” based on the stratigraphy of Tabun Cave and other coastal sites. These phases were originally defined on the basis of variation in the relative frequencies of Levallois tools and retouched artefacts (Copeland 1975). During the 1980s, researchers using the *chaîne opératoire*

(operational sequence) methodology augmented the definitions of these phases with descriptions of variation in core preparation and reduction strategies (Bar-Yosef and Meignen 1992).

Phase 1, Tabun D-Type, or “Early Mousterian” assemblages feature elongated debitage, much of which was struck by unidirectional or bidirectional-opposed preparation of Levallois cores. Endscrapers, backed knives, burins, and other so-called “Upper Palaeolithic” retouched tool types are common. The most diagnostic artefact of this phase is the “Abu Sif knife”, an elongated Levallois point or Mousterian point with invasive distal retouch (Fig. 8.3, 1–2).

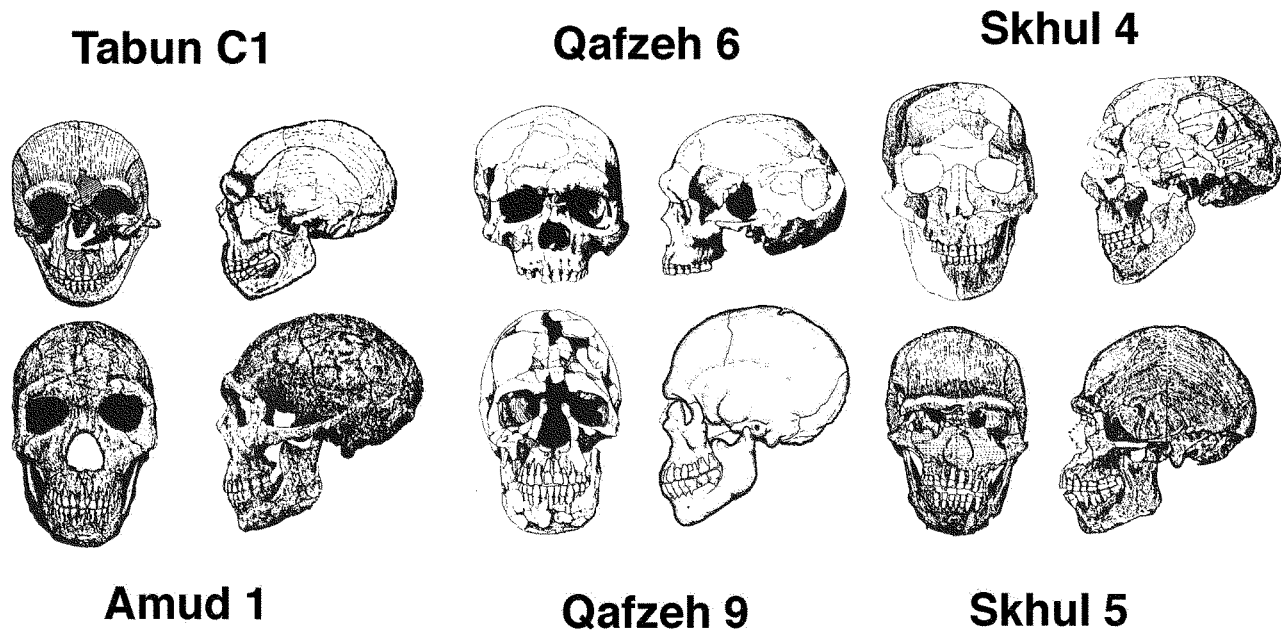


Figure 8.2. Crania of Levantine Neanderthal and early *Homo sapiens* fossils.

Phase 2 or Tabun C-Type assemblages feature products of recurrent radial-centripetal Levallois core reduction. Sidescrapers are common and points/triangular flakes vary widely in frequency. The most diagnostic artefacts are large oval Levallois flakes (Fig. 8.3, 5–7).

Phase 3 or Tabun B-Type/Later Mousterian assemblages feature variable proportions of flakes and blades indicating unidirectional-convergent and radial-centripetal core preparation. The most diagnostic artefacts are isosceles Levallois points of widely variable sizes (Fig. 8.3, 8–10).

Although this three-phase framework is widely used, there remain many unanswered questions about Levantine Mousterian industrial variability.

The origins of the Levantine Mousterian remain unclear. Phase 1 assemblages did not demonstrably spread into the Levant from an adjacent region. The hypothesis that Levantine Mousterian “developed” out of a local Late Acheulean industry (the Acheulo-Yabrudian) is undercut by stratigraphic uncertainties regarding putatively transitional sequences at Tabun Cave and Hummal.

Describing Levantine Mousterian in terms of “phases” implies a degree of continuity that is not clearly demonstrable. Major “break points” between these phases coincide with episodes of rapid climatic change 128, 75 and 45 ka BP. Such changes could have caused shifts in hominin adaptive strategies, or change in hominin populations, or both.

There are few stark contrasts in the Levantine Mousterian assemblages associated with Neanderthals and early *Homo*

sapiens. Both hominins used a similar range of techniques for core reduction and tool production. These similarities are often cited as evidence of contact and cultural continuity between Levantine Neanderthals and early *Homo sapiens* (Wolpoff 1989; Clark 1992; Hovers 2006). Yet, the same stone tool types as those found in Levantine MP assemblages are also known from a wide range of Eurasian and African MP contexts. This widespread distribution indicates that these tools reflect evolutionarily primitive aspects of hominin technological strategies. The most parsimonious explanation for similarities among Levantine Mousterian assemblages is that they reflect convergence in Neanderthals’ and early *Homo sapiens*’ technological strategies (Shea 2006a).

The Initial Upper Palaeolithic assemblages that follow the Levantine Mousterian between 45–40 ka BP feature increasing emphasis on prismatic blade production, and decreasing use of Levallois techniques. Characteristically Initial Upper Palaeolithic artefact-types, such as basally-retouched Emireh points, Umm El Tlel points, and obliquely-retouched (*chamfrein*) endscrapers (Kuhn 2003) are not particularly common in either late Levantine Mousterian contexts or in Early Ahmarian ones dating 38–25 ka BP (Belfer-Cohen and Goring-Morris 2003). Other than isolated teeth (which few physical anthropologists consider diagnostic to species), the first post-MP human fossils are those of *Homo sapiens* associated in Upper Palaeolithic “Early Ahmarian” contexts at Ksar Akil and Qafzeh. Most Levantine prehistorians view evidence for cultural continuity

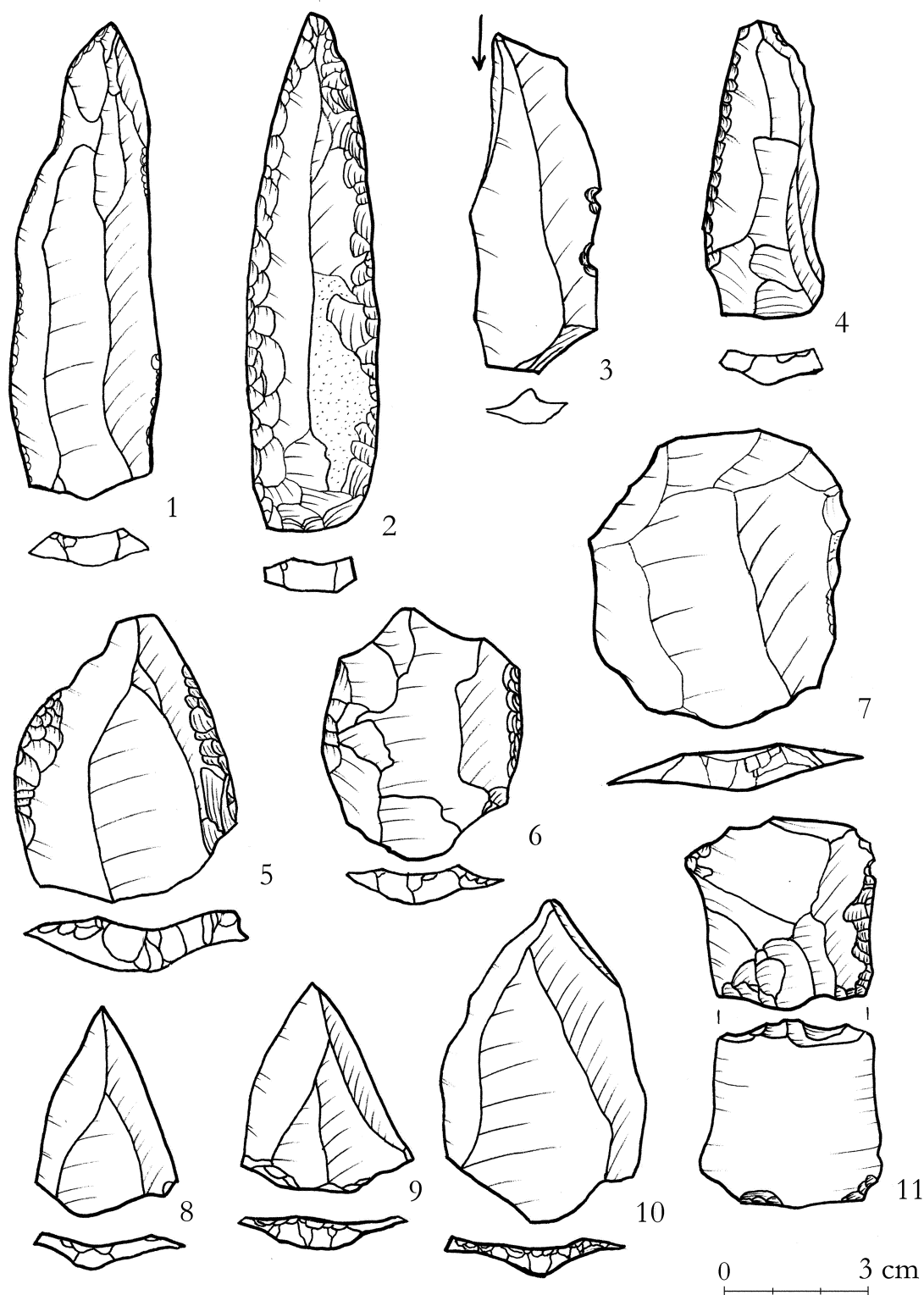


Figure 8.3. Levantine Mousterian stone tools. 1. Elongated Levallois point; 2. Abu Sif knife (retouched elongated Levallois point); 3. Burin on blade; 4. Backed blade; 5. Double sidescraper on Levallois point; 6. Sidescraper on Levallois flake; 7. Levallois flake; 8–10. Levallois points; 11. Truncated-faceted piece (Sources: 1–4. Tabun, Unit IX; 5–7, 11. Qafzeh, Units XIII–XV; 8–10. Kebara, Units IX–XII).

across the Middle–Upper Palaeolithic “transition” in the Levant as compelling, even though there are no clear hominin fossil associations for the relevant “transitional” assemblages.

Middle Palaeolithic behaviour

By pooling archaeological evidence from several dozen Levantine sites, one can frame some general observations about shared features of Levantine MP hominin behaviour. These observations can be organized in terms of settlement, subsistence, technology and sociality.

Settlement

Human settlement during the MP was closely tethered to the Mediterranean woodland and its ecotone (transition zone) with the Irano-Turanian steppe. Environmentally sensitive microfaunal assemblages and pollen evidence from MP sites are dominated by woodland species, but there is usually a significant secondary concentration of steppe species as well (Weinstein-Evron 1990; Tchernov 1998). The oak-terebinth woodlands of the East Mediterranean are among the richest ecozones in western Eurasia (Zohary 1973). Though the Irano-Turanian steppe offers few plant food resources to preagricultural foragers (Hillman 1996), seasonally migrating herds of large game would have been attractive targets for MP hunters (Shea 1998). Sites from the interior Levant, such as Dederiyeh, Umm el Tlel, and Yabrud 1, feature high proportions of steppe-dwelling species. Surface exposures of MP artefacts in now-desertic parts of the interior and southern Levant desert probably reflect short-lived expansions of woodlands and human populations driven by episodic increases in temperature and humidity.

Early and Later MP assemblages preserve contrasting evidence for residential mobility patterns. Early Mousterian contexts, such as Hayonim Lower Level E, Tabun Unit IX, and ‘Ain Difla, preserve artefacts and faunal remains at relatively low densities. Later Mousterian contexts preserve higher densities of lithic and faunal evidence. Meignen and colleagues (2006) infer from these contrasts a shift from more ephemeral to more sustained occupations over the course of the MP (see also Binford 1968; Lieberman and Shea 1994). This inferred Later MP increase in residential stability also finds support from evidence for increased production of expedient cores, a phenomenon correlated with increased sedentism in recent contexts (Wallace and Shea 2006).

Functional differentiation of living space into knapping areas, trash middens, and hearth areas is often treated as a derived feature of Upper Palaeolithic/“modern” human behaviour. Yet, Kebara, Amud, and Tor Faraj preserve evidence for internal structural differentiation (Meignen and Bar-Yosef 1989; Henry *et al.* 2004; Alpers-Afil and

Hovers 2005). Kebara and Amud are demonstrably associated with Neanderthal fossils and the Tor Faraj assemblage is attributed to them based on lithic typology.

Subsistence

In spite of a richness of plant food resources in the Mediterranean woodland, we know very little about the plant food component of MP human diet. Archaeobotanical remains from Kebara and Amud preserve carbonized seeds and phytoliths of such plant foods as terebinth, oak, vetch, lentil, and cereal grasses (Madella *et al.* 2002; Lev *et al.* 2005). Hackberry (*Celtis*) seeds were recovered from Douara Cave (Akazawa 1987). MP humans did not leave behind nut-cracking stones or other aids for processing seeds. Pitted stones used to crack nuts and/or seeds have been recovered from Early Palaeolithic contexts at Gesher Benot Ya’acov, c. 800–700 ka BP (Goren-Inbar 1990), as well as at numerous later Upper Palaeolithic and Epipalaeolithic sites. The absence of nut and seed processing equipment from MP contexts remains an enigma.

Large mammal remains from most MP sites in the Levant include aurochs (wild cattle), horse, red deer, fallow deer, gazelle, ibex, and boar (Shea 2003a, 351–354). Remains of megafauna (elephant, rhino, hippopotamus) and small animals (birds, tortoise, lagomorphs) are rare (Stiner 2006). Faunal assemblages from sites located in those parts of the Levant most persistently covered by woodland vegetation (*i.e.*, those in Lebanon, western Syria and northern Israel) are dominated by the remains of territorial species (red deer, fallow deer, roe deer, boar, gazelle). Migratory species (aurochs, onager, rhino, camel, hartebeest, and ibex) are more common in faunal assemblages from interior steppe-desert areas (central Syria, southern Israel, and Jordan). Desert-adapted species, such as oryx and camel, are known mainly from MP sites near inland oases, such as El Kowm and Umm El Tlel (both in Syria) and Azraq (Jordan).

MP humans hunted and scavenged, as do most large terrestrial predators and some recent human hunter-gatherers. Large mammal remains from MP contexts are dominated by those of prime-aged individuals, a pattern usually interpreted as evidence for ambush hunting (Stiner 2006). In terms of prey species, there is no evidence for major contrasts in Neanderthal vs. early *Homo sapiens* subsistence.

Technology

Flint is relatively common throughout much of the Levant, and most Levantine Mousterian assemblages are made of flint/chert procured from primarily local (<10 km) sources (Shea 2003a). A small but variable proportion of raw materials is from more distant sources, as is the case in most Eurasian and African MP assemblages (Feblot-Augustins 1997). In contrast to European and West Asian Mousterian complexes, Levallois core reduction products are relatively



Figure 8.4. Burial of Skhul 5 (after Garrod and Bate 1937, Plate LII.2).

common and heavily retouched tools relatively rare. If the retouched tool components of Levantine Mousterian assemblages reflect curated “personal gear”, then the scarcity of heavily retouched tools in the Levantine Mousterian might reflect land use strategies involving relatively lower residential mobility, something one might reasonably infer from the ecological richness of Mediterranean woodland habitats (Rolland and Dibble 1990).

Levantine MP humans attached pointed flakes (mainly Levallois points and allied forms) to wooden shafts, and used them as tips for hand-cast spears – spears thrust or thrown at their targets from close quarters (Shea 1988). Stone spear point use remains a puzzling contrast with Eurasian Mousterian assemblages, in which there is relatively little evidence for this practice (Shea 1997). In

this respect, the Levantine Mousterian is rather more like penecontemporaneous African assemblages, in which there is clear and abundant evidence for the use of stone-tipped spears and other weapons (Brooks *et al.* 2006; Shea 2006b).

Sociality

Evidence concerning Levantine MP social behaviour mainly involves exosomatic symbols. This evidence takes several forms, including mortuary practices, long-distance transport of non-food objects, colour symbolism, and repetitive markings on stone (Shea 2003a, 357–362).

Six Levantine sites (Tabun, Skhul, Kebara, Qafzeh, Amud, and Dederiyeh – seven if one includes Shanidar from further afield in Iraq) preserve human skeletal remains in anatomical articulation. These are generally regarded as deliberate burials, rather than fortuitously preserved natural deaths (Belfer-Cohen and Hovers 1992). Three of these burials were interred with mortuary furniture (“grave goods”). Skhul 5 is an adult male buried with a boar mandible under his arm (Fig. 8.4). Qafzeh 11, a teenager, was buried with deer antler clasped in his hands and tucked beneath his chin (Fig. 8.5). Amud 7, a neonate, was buried with a red deer maxilla on its chest. There are two double burials. The Tabun C1 Neanderthal was buried with a neonate whose remains were not recovered. Qafzeh 9, an adult female, was buried with a child, Qafzeh 10, at its feet. The removal of Kebara 2’s cranium some months after burial hints at symbolic behaviour, but a non-symbolic cause cannot be ruled out.

Ochre, ochre-painted shells and ochre-stained stone tools from Qafzeh suggest both a system of colour symbolism and evidence for the long-distance transport of non-food items (Hovers *et al.* 2003; Taborin 2003). The naturally perforated shells from Qafzeh were transported there from the Mediterranean coast, at least 30 km away. Specimens of inedible marine mollusks and perforated shells were also recovered at Skhul (Vanhaeren *et al.* 2006).

Three stones with repetitive linear markings from Ras El Kelb, Qafzeh, and Biqat Quneitra are thought to be symbolic artefacts (Goren-Inbar 1990; Hovers *et al.* 1997; Moloney 1998) (Fig. 8.6).

Though much of the evidence for Levantine MP symbolic behaviour comes from Skhul and Qafzeh, it is probably not the case that only *Homo sapiens* produced symbolic artefacts and used them in social interactions. Burials, mineral pigments, transported shells, and repetitively marked artefacts are known from European Neanderthal contexts as well (d’Errico 2003). The Levantine evidence for MP symbolic behaviour shares with its European MP and African MSA counterparts the qualities of idiosyncrasy (the evidence rarely takes the same form at more than one site) and recursion (the behaviour does not persist for

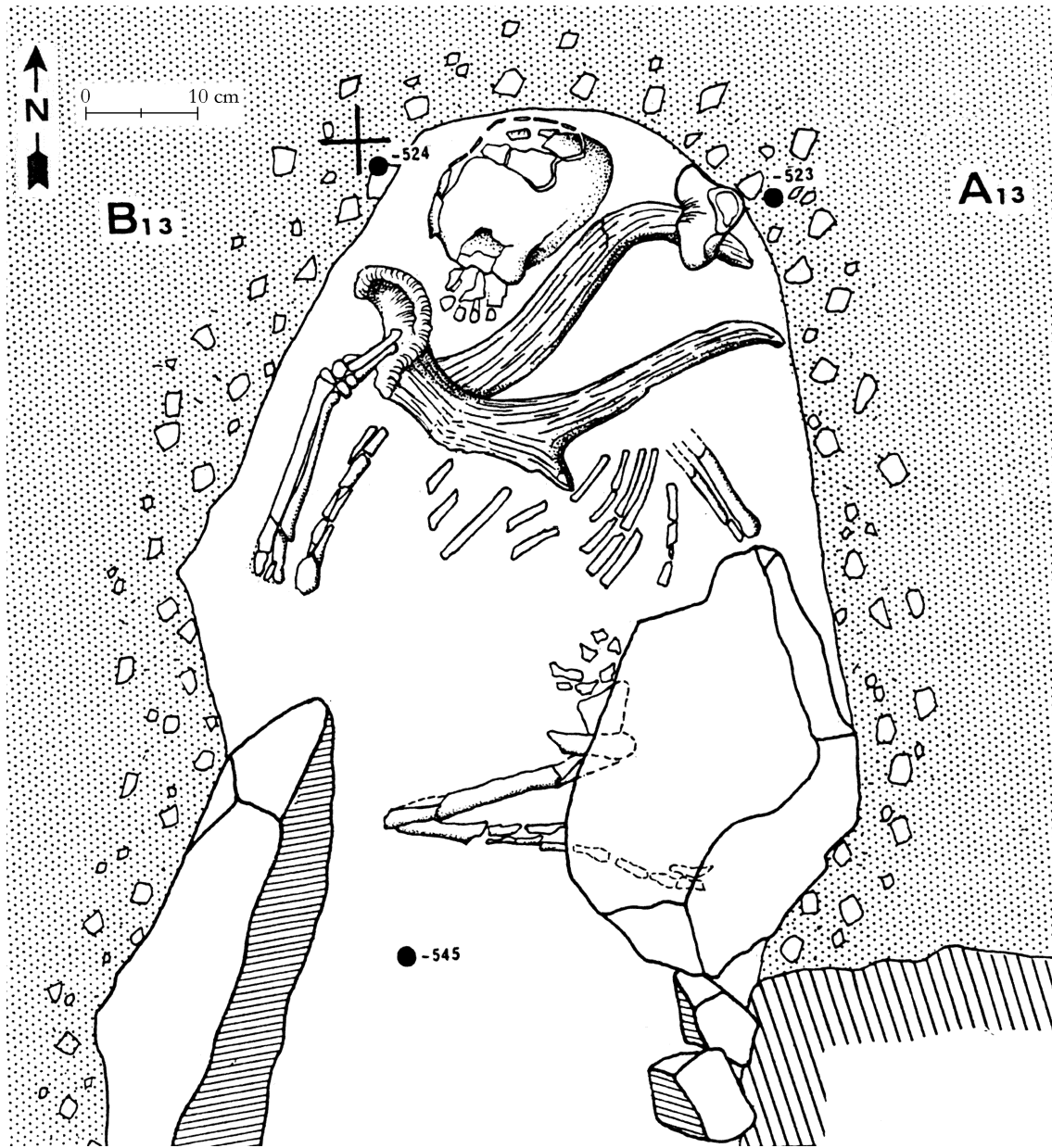


Figure 8.5. Burial of Qafzeh 11 (after Vandermeersch 1970).

prolonged periods) (Shea 2006a). The contrast with widespread and consistent evidence for symbolic behaviour in all these regions after 50–40 ka BP could not be starker. If the Levantine evidence cited above does indeed reflect the social use of symbols, then MP hominins, Neanderthals and early *Homo sapiens* alike, used symbols in very different ways from recent humans (Henshilwood and Marean 2003).

What happened in the Levant during the Middle Palaeolithic period?

For much of the Pleistocene the Levant was a biogeographic corridor, a “crossroad of the continents”, that facilitated the dispersals of plants, animals, and human populations between Africa and Eurasia. During humid periods, as the woodlands expanded, it would have been a magnet for hominin populations experiencing growth in adjacent regions. During arid periods, however, the region became

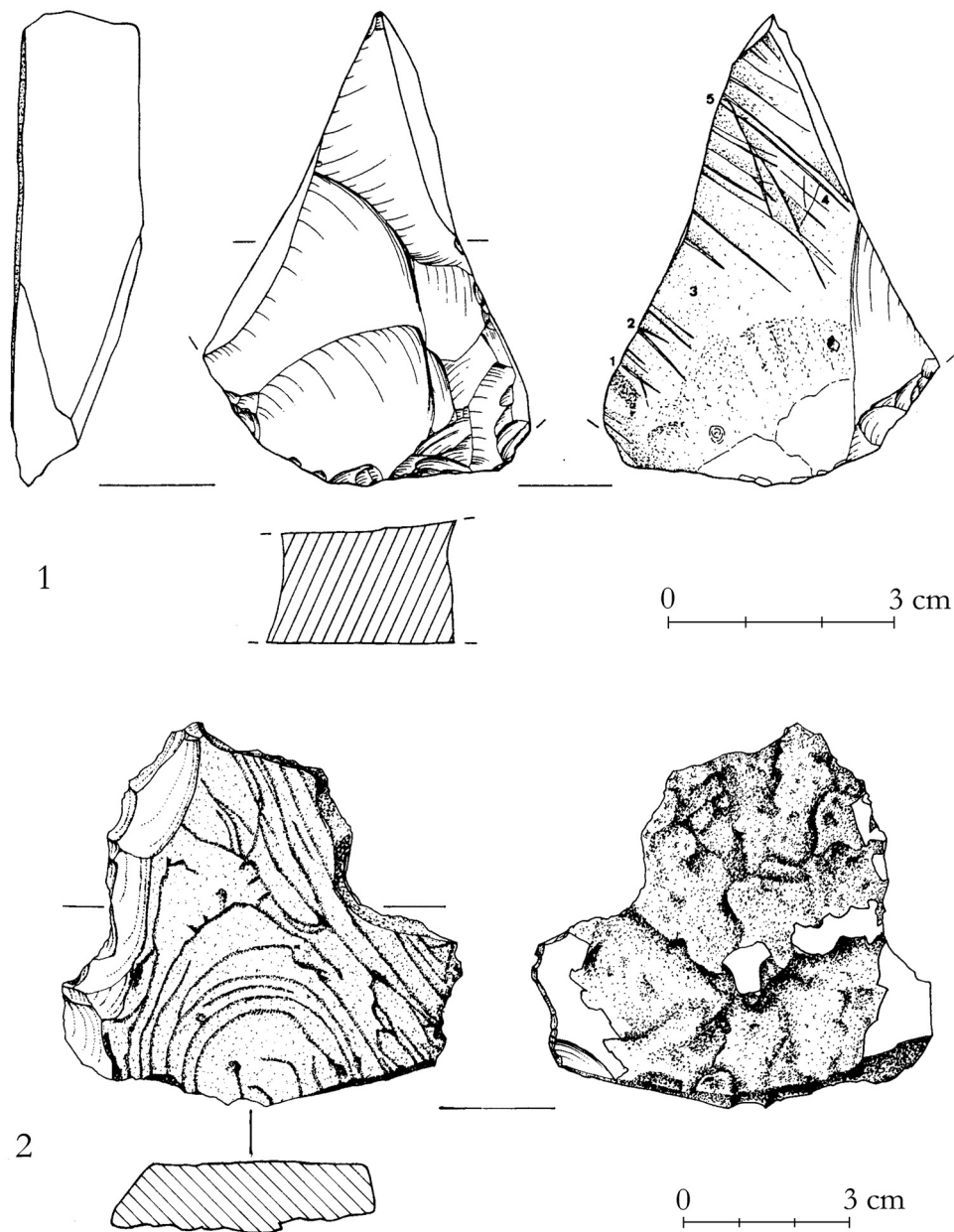


Figure 8.6. Incised stone artefacts from MP contexts at (1) Biqat Quneitra and (2) Qafzeh (after Goren-Inbar 1990, 238; Hovers *et al.* 1997).

very much like an island, one bounded by desert, ocean and mountains. Large-bodied, slow-reproducing mammals do not fare well on islands in the long term. Circumscribed environments increase the risks of foraging shortfalls, inbreeding, reproductive deficits, and extinction (MacArthur and Wilson 1967). Circumscription also increases competitive pressure among species with similar ecological niches, particularly large carnivores (Van Valkenburgh 2001).

Though neither Neanderthals nor early *Homo sapiens* were likely obligate carnivores, large mammal prey were clearly important parts of their diets.

The evolutionary and ecological effects of circumscription are greater still among small populations, and the Pleistocene hominin population of the Levant can never have been very large. Estimates of the Levant's MP population based on demographic studies of recent human hunter-gatherers in

analogous temperate environments project a regional population of only around 5000 individuals (Shea 2007b). If one accepts the mounting evidence that MP human subsistence strategies were significantly less effective than those of recent human hunter-gatherers (Stiner 2006), then these population sizes must have been smaller still. Under colder and arid conditions, the Levant's human population could have dropped below minimum viable levels. Whether or not there was actual face-to-face competition among Levantine hominins for the same resources (Shea 2003b), rapid climate change and wide climatic variability throughout the Late Pleistocene probably caused numerous extinctions and turnovers among Levantine hominin populations (Shea 2008).

The nature of the hominin populations who lived in the Levant during MIS 8–6, remains unclear due to a sparse fossil record associated with Late Lower Palaeolithic and Early Mousterian assemblages. By the end of the Middle Pleistocene, however, there is evidence for the presence of both Neanderthal and early *Homo sapiens* populations in the region. The origins of the Levantine Neanderthals are unknown. The Levant might have been within the geographic range of Neanderthal origin, or it might not. Without fossils neither hypothesis can be rejected. The oldest *Homo sapiens* fossils, Omo Kibish and Herto Bouri (both in Ethiopia) date to 200–150 ka BP (White *et al.* 2003; Fleagle *et al.* 2008). The Skhul/Qafzeh humans could reflect a northward dispersal of these African *Homo sapiens* populations during a warm, humid episode early in MIS 5 (Shea and Bar-Yosef 2005). The only Neanderthal fossil plausibly dated to this period, Tabun C1, has so many uncertainties about its stratigraphic provenience that it cannot be linked to a particular archaeological assemblage (Bar-Yosef and Callendar 1999). Apart from other isolated teeth and individual bones of uncertain provenance from Tabun, no other Levantine Neanderthal fossils are reliably dated to the early MIS 5. During this period, Neanderthals may have retreated from a steadily warming Levant. Alternatively, African *Homo sapiens* populations may have competitively displaced them. Neither hypothesis can be rejected at present.

Steadily colder and more arid conditions through the course of MIS 5 (128–75 ka BP) posed considerable adaptive challenges for all Levantine human populations. During this same period, Africa experienced a series of megadroughts (Cohen *et al.* 2007). African populations living in the likely core areas of human settlement, woodlands located near stable water sources, augmented their diet by exploiting food resources in nearby savannas (Barut Kusimba 1999; Brandt 2006; Shea 2007a; Basell 2008). These savanna resources included abundant plant underground storage organs (tubers) and migrating herds of large mammals. The steppes and deserts that border the Levant were relatively impoverished in such resources, primarily as a consequence

of colder temperatures. Increased aridity during MIS 5 likely packed the Levant's human populations into smaller and smaller woodland refugia along the Mediterranean coast, the hilly flanks of the northern Jordan Valley, and the foothills of the Taurus-Zagros mountains. Lacking the savanna resources of their African counterparts, the Levant's human populations undoubtedly faced a variety of ecological crises as the inhabitable area of the region dwindled. Evidence for exosomatic symbolic behaviour, the use of mineral pigments, long-distance transfers of non-utilitarian shells, and the inclusion of grave goods into mortuary practices may reflect efforts by the Skhul/Qafzeh humans to cope with the social stresses of a deteriorating habitat by recourse to symbolically-mediated social networks (Shea and Bar-Yosef 2005). The non-repetitive nature of this evidence, and, more tellingly, its absence from Levantine MP contexts between 75 and 45 ka BP, indicate that in the end, the Skhul/Qafzeh humans' adaptive strategies failed them. *Homo sapiens* disappeared from the Levant fossil record around 80–70 ka BP. They did not appear again until around 40 ka BP, in early Upper Palaeolithic times, presumably dispersing into the region from Africa, Arabia, or southern Asia.

There is a plausible climatic cause for the disappearance early *Homo sapiens* around this time. The transition from MIS 5a to MIS 4, c. 75 ka BP, was among the most abrupt changes of climate in recent earth history (Rampino and Self 1992). Some evidence links this abrupt change to a "volcanic winter" caused by the eruption of the Mt. Toba (Indonesia) super-volcano (Ambrose 2003). Whatever its cause, such an abrupt shift to colder conditions might have driven the Skhul/Qafzeh humans to extinction or forced them to abandon the Levant. Cold-tolerant Neanderthal populations had a physiological advantage over tropical African humans, possibly one significant enough to confer an advantage in re-colonizing the Levant during the cold conditions of MIS 4.

Understanding the failure of the Skhul/Qafzeh humans' descendants to persist in the Levant and disperse beyond it requires us to consider the nature of the differences between Middle and Upper Palaeolithic *Homo sapiens* populations (Klein 1998). One obvious archaeological contrast between Levantine Middle and Upper Palaeolithic records is evidence for the use of projectile weaponry (Shea 2006b).

The use of projectile weaponry is a human cultural universal. Every ethnographic, historic and archaeologically known human population over the last 50,000 years used projectile weapons (*i.e.*, low-mass/high velocity weapon systems like the spearthrower and dart, the bow and arrow, or more recently firearms). Those few groups who lacked projectile weapons, such as 18th–19th century Tasmanian Aborigines, are descended from populations who possessed them. Projectile weaponry is also uniquely derived among recent *Homo sapiens* populations. The humeri and scapulae

of Neanderthals, earlier hominins, and the Skhul/Qafzeh humans as well, do not feature the characteristic patterns of bone remodelling that form in response to the torsional forces involved in throwing (Churchill 2002). The ballistically significant dimensions of Levallois points and Mousterian points associated with Levantine and European MP humans are significantly larger than the ethnographic projectile points (Shea 2003a, 370). Levantine Upper Palaeolithic point types (Ksar Akil points, el Wad points, and allied forms) do not differ significantly from the ballistically significant dimensions of ethnographic stone projectile points still attached to their handles (Shea 2006b).

The earliest lithic evidence for projectile technology occurs among African contexts dating to between 100–50 ka BP (Shea 2006b). Most MSA stone points are larger than ethnographic projectile points, but in nearly all samples of such points there is a significant minority whose ballistically significant dimensions overlap with those of known projectile points. The evidence available suggests that projectile weapons incorporating stone and bone armatures originated in Africa between 100–50 ka BP then spread to Eurasia along with Upper Palaeolithic *Homo sapiens* populations. This pattern of emergence, dispersal, and the near-universal retention of projectile weaponry among recent hunter-gatherers suggests projectile weaponry was a key factor in *Homo sapiens*' successful return to the Levant and our dispersal beyond it after 45 ka BP.

The origins of projectile technology can be understood in terms of a strategic shift to a broader ecological niche (Kuhn and Stiner 2001; O'Connell 2006). Weapon systems like the spearthrower and bow allow their users to vary launch speeds and firing rates to suit a wide range of targets. A bow used to launch arrows at a bison can also be used to stop a deer, a rabbit, or a fish, or a human being. The same is not true of heavy hand-cast spears or of clubs or throwing sticks. The appearance of lithic and bone projectile points in the Levant after 45 ka BP coincides with zooarchaeological evidence for subsistence diversification (Bar-Yosef 2002). There is more consistent evidence for the systematic exploitation of smaller prey species (e.g., birds, and lagomorphs) and towards more effective hunting of larger game (Stiner 2006). These trends continued along with the spread of *Homo sapiens* and Upper Palaeolithic assemblages beyond the Levant (Mellars 2005). They are not found in the archaeological record associated with Neanderthals or with any other Late Pleistocene hominin (Mellars 1996).

Why did this strategic and ecological transformation occur among African *Homo sapiens* and not among other hominins? It is not that our African ancestors were “natural-born killers”. Rather, their uniquely derived behavioural strategies evolved in response to the ecological richness of African habitats, geographically – and historically – contingent patterns of climate change, and these factors'

effects on population growth. African equatorial habitats feature greater plant and animal species diversity than their temperate Eurasian counterparts (Groombridge and Jenkins 2002). Consequently, they offer superior opportunities for human economic diversification. Incentives for ecological diversification became increasingly common throughout the Pleistocene, as northern hemisphere glacial cycles resulted in repeated and prolonged episodes of aridity and desert growth in Africa (deMenocal 2004). The numerous reductions of breeding populations (“bottlenecks”) inferred from genetic variation among living humans support a scenario in which African human populations were repeatedly packed into equatorial woodland refugia (Ambrose 1998). Within these refugia, there were powerful incentives for subsistence diversification, including improvements in pre-existing subsistence technology, such as traps, nets, and plant-processing equipment. The amelioration of arid conditions provided opportunities for these innovations, and the populations who created them, to expand out of equatorial African habitats, south towards the Cape and north towards Arabia and the Levant (Shea 2007a, 2008).

Improvements in projectile technology had spillover effects on social organisation, both in securing a stable subsistence base and in facilitating larger and more effective alliance networks. As Bingham (2000) has argued, the availability of projectile weaponry may have, for the first time in human evolution, made possible the formation of large, stable social coalitions of unrelated individuals. The availability of projectile weapons dramatically lowers cost/benefit ratio for coalition enforcement, that is, for effectively deterring “cheaters” and “free-riders” who would otherwise present significant obstacles to the formation of large, stable, alliance networks among regional human populations. Personal adornments and other exosomatic symbols allow their users to overcome linguistic differences and other potential obstacles to cooperation and reciprocity among strangers belonging to the same larger “culture” (Gamble 1982). Consistent evidence for the use of personal adornments and mortuary ritual in Africa and Eurasia after 45 ka BP (Kuhn *et al.* 2001; d'Errico *et al.* 2003; Vanhaeren and d'Errico 2006) may reflect *Homo sapiens* populations extending strategies of using symbols in local interactions to forge stable alliance networks on a regional scale. Evidence from the Levant that MP *Homo sapiens* were already using exosomatic symbols, including pigments and personal adornment shows that in the absence of projectile weaponry symbolic behaviour was insufficient to confer *Homo sapiens* a decisive advantage over rival hominin species. That projectile weapons and exosomatic symbols occur nearly everywhere with *Homo sapiens* after 45 ka BP suggests that it was projectile weaponry, not symbolic behaviour, the bow and the spearthrower, not the beads and red ochre, that underwrote our species' global ecological dominion.

The return of *Homo sapiens* to the Levant in the Upper Palaeolithic was not driven solely by changes in human adaptive strategies. The final millennia of the MP fall within MIS 3, a period when global climate was uniquely highly variable. Conditions in the Levant are strongly influenced by weather patterns reflecting changes in the circulation of oceanic currents in the North Atlantic (Enzel *et al.* 2008). Sediment cores, isotopic studies of speleothems, and pollen spectra register a shift towards cold and arid conditions *c.* 47–30 ka BP (Almogi-Labin *et al.* 2004). These changes reduced the portion of the Levant amenable to hominin settlement. Among recent human hunter-gatherers, prolonged occupations of the same residential site usually lead to rapid depletion of local plant and animal food sources. Later Levantine Mousterian contexts provide evidence that Levantine Neanderthal populations were having to intensify their subsistence activities around residential sites (Lieberman and Shea 1994). At Kebara, this prolonged occupation was accompanied by a decline in red deer and aurochs and increased numbers of smaller species (gazelle and fallow deer) that is consistent with over-hunting (Speth and Clark 2006). These same contexts feature evidence for the increased production of stone spear points (Lieberman and Shea 1994). Recent human hunter-gatherers who use stone-tipped weapons do so primarily to hunt large terrestrial game and in warfare. Such a strategy contrasts with the one *Homo sapiens* populations adopted around this time, a strategy of broadening their subsistence base by procuring larger quantities of plant and small animal food sources and forming extensive networks of alliances organised at regional scales (Stiner and Kuhn 2006).

In this respect the evidence for the Neanderthal “endgame” in the Levant prefigures a pattern that repeats itself elsewhere in western Eurasia. Throughout Europe and western Asia, final Middle Palaeolithic and putatively “transitional” lithic assemblages associated with Neanderthals are marked by increased production of pointed stone artefacts widely assumed to have been hafted weapon armatures (Mellars 1996; Teyssandier 2008). The limited samples of these points thus far studied are too thick and heavy to be projectile weapons and are more likely spear points (Shea 2006b). As in the Levant, the assemblages containing these thick heavy points are replaced by ones containing stone and bone/antler points that match morphometric criteria for projectile armatures. The hominin fossil associations of these earliest Upper Palaeolithic assemblages remain unclear, but after they appear in a particular region, only *Homo sapiens* fossils are deposited thereafter. Systematic stone point production by Neanderthals appears to be a sign of a species in evolutionary trouble and an accurate predictor of their imminent extinction. Such divergent outcomes of similar behaviour probably point to a key factor in Neanderthals “replacement” by *Homo sapiens*.

The Levant was at the periphery of the Neanderthals’

geographic distribution. It follows that their foothold there was more precarious than in the core area of their geographic range. A more arid climate after 47–45 ka BP may have caused a sufficient reduction in Levantine Neanderthal populations to allow *Homo sapiens* to disperse into the Levant. If they did, the niche broadening effects of projectile technology may have enabled *Homo sapiens* populations to capture calories that were unavailable to Neanderthal populations and to persist in a region of otherwise marginal value to their evolutionary rivals. Moving into the Levant and temperate Eurasia would also have brought *Homo sapiens* out of reach of the zoonotic (animal-transmitted) diseases and parasites, like malaria, that had co-evolved with humans for millions of years (Bar-Yosef and Belfer-Cohen 2001). The absence of predators and parasites often allow “invader” species in modern contexts to undergo astonishingly rapid population increases (Crosby 1986).

It is not easy to explain why Neanderthals did not also develop projectile weaponry and other niche-broadening technologies, but it is unlikely to reflect deficient intellect (Speth 2004). Neanderthals survived for thousands of years in the harshest habitats ever occupied by primates. They must have been strong, smart, and stoic, but they were no fools. Projectile weapons, as well as nets, traps, and others of the kinds of complex subsistence aids associated with Upper Palaeolithic and later human hunter-gatherers require substantial intelligence to devise, but they also require considerable outlays of time in advance of use and in maintenance (Oswalt 1976). Neanderthals’ higher energetic requirements (Churchill 2006) may have created disincentives for investing a considerable time on complex and specialized technology and strong selective pressure for adaptive strategies involving proficiency with simpler and versatile subsistence aids. There is nothing intrinsically maladaptive about a strategy using simple versatile tools to focus on a narrow range of prey. It probably yielded high energetic returns, and if this is what Neanderthals did, it plainly worked well for a long time and in many different environments. In comparing strategies, however, context is all-important. In the context of the Levantine biogeographic corridor during a period of resource stress, such a strategy would have been vulnerable to a *Homo sapiens* counter-strategy of using specialised tools to construct a broad ecological niche. But for the context of climatically forced habitat degradation *ca.* 47–45 ka that created selective pressure for niche-broadening, Neanderthals might have remained in the Levant indefinitely.

Conclusion

There were several points of discontinuity in the course of Levantine Late Pleistocene hominin evolution during Late Pleistocene times. These discontinuities are indicated by turnovers among hominin fossils and correlated changes in

the archaeological record. The timing of these events suggests climate change played a major forcing role. The disappearance of *Homo sapiens* fossils from the Levantine fossil record 75–45 ka is likely real, and it is the only known instance where our species was replaced by another hominin. Neanderthal extinction *c.* 45 ka and *Homo sapiens*' subsequent evolutionary success is most plausibly explicable in terms of the eternal struggle between specialist and generalist ecological strategies. In evolution, generalists usually almost always beat specialists.

It is not impossible that Levant's UP *Homo sapiens* populations evolved locally through some as-yet-unspecified evolutionary process that left no clear evidence of that continuity in the archaeological record, hominin fossils, or the recent human genome, but this is an argument, not an hypothesis. It has no evidentiary basis and it cannot be falsified.

The same forces that shape the writing of history affect writing prehistory. In the Levant, prehistory has long been influenced by European scholarship. Prehistoric research began in Europe, and many of the assumptions about European Neanderthals and early *Homo sapiens* were exported to the Levant by prehistorians trained in Europe. In Europe, the MP period is generally seen as a period of stasis, the "Age of Neanderthal Man". Apart from some minor shifts in flint knapping strategies and changes in which particular large mammals were on the menu, not much happened. The MP of the Levant, in contrast, was a period of dynamic evolutionary change and dramatic reversals of fortune for both Neanderthals and *Homo sapiens*. The exact nature of Neanderthal-*Homo sapiens* interactions during this period (if indeed they interacted at all) will probably never be known with great certainty. Nevertheless, it must have been an exciting time and place in which to have lived.

In explaining the course of human evolution during the MP and UP periods, Levantine prehistorians and foreign scientists who work there have shown a persistent preference for models that invoke evolutionary continuity, favouring co-existence and assimilation of some kind over competition, extinction, and replacement. This preference for continuity as the default model for human origins in the Levant reflects a misunderstanding about the fundamental processes of evolution and a tacit understanding of the politics of contemporary human origins research. That is, it is far better for one's career to present one's fossil, archaeological site, or chosen region of geographic expertise as central to the main narrative of human evolution than it is to realistically assess the actual improbability of it having such a central role.

Competition, extinction, and replacement in prehistory are often conflated with recent historical colonial encounters. Few of us take pride in having ancestors (recent or Pleistocene) with others' blood on their hands, but all our ancestors do. Competition, extinction, and replacement are

how natural selection actually happens. That these processes are involved in historical events we hold in low regard ought to have no bearing on how we assess them as explanations for scientific evidence. And yet, subjective factors do impinge on explanations for human origins and evolution.

Continuity implies relevance to the main narrative of human evolution. Hominins that are plausibly ancestral to us command far more scholarly interest and priority for funding than ones that are not ancestral. Palaeoanthropologists enjoy far greater financial support and their findings command far greater popular interest than any other field of mammal palaeontology. Much of the popular interest in Neanderthals springs not so much from a theoretical imperative to understand them in their own right, but rather a desire to know what their origins, behaviour, and extinction say about our evolutionary history. This is not how things ought to be in science, but it is the way they are.

Few Levantine prehistorians are Africanists or specialists in the prehistory of South Asia. Predictably, Europe (and to a lesser extent West Asia) are the main focus in any search for inter-regional connections and population movements. This Eurasian focus has led Levantine prehistorians to systematically neglect the most likely source of the region's Middle and Upper Palaeolithic *Homo sapiens* populations, namely Africa. There is today an exceptional convergence of geochronometric, archaeological, fossil, genetic, and even linguistic evidence that point unambiguously to Africa, specifically sub-Saharan eastern Africa, as the place where our species first evolved and from which it dispersed to the Levant and elsewhere (Ehret *et al.* 2004; Trinkaus 2005; Mellars 2006b; Grine *et al.* 2007; Shea 2007a; Fleagle *et al.* 2008). These findings do not diminish the value of Levantine prehistory for human origins research, but they do mean that the Levantine record has to be put in a broader evolutionary context. It is not merely an appendix to European prehistory, nor a suburb of "Greater Africa", but a unique region whose prehistoric record differs fundamentally from the two continents it joins together.

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The Levantine Upper Palaeolithic and Epipalaeolithic

Ofer Bar-Yosef and Anna Belfer-Cohen

Opening comments

The Levantine Upper Palaeolithic and the early phases of the Epipalaeolithic contribute to our understanding of two critical issues in the eastern Mediterranean archaeology. The first is the transition from the Middle to the Upper Palaeolithic that marked the advent of modern humans out of Africa unto Eurasia. The second relates to the foundations of the so-called Epipalaeolithic cultures in this region among whom certain groups became the first farmers.

In the following pages we summarize the current archaeological knowledge on this period. It should be noted that the definition of the Levantine Upper Palaeolithic as a period was established by the pioneer researchers such as D. Garrod, R. Neuville, and M. Stekelis during the 1930s and was accepted by the ensuing generations of prehistorians in the Levant. The study of the lithic industries was, as in western Europe, the basis for identifying “prehistoric cultures”. This approach is quite established and therefore we will not deal with the issues of whether the recognized entities indeed reflect the presence of distinct living populations. Suffice it to say that the notion of particular information transmission through teaching assisted by language and expressed in the selection of raw materials, the knapping techniques, tool use and discard patterns, is based on a wide range of cognitive research that allows us to accept the contention that prehistoric cultures may represent ethno-linguistic groups (*e.g.*, Birdsell 1985; Marlowe 2005).

Before delving into the reconstruction of what we feel is a reasonable narration of the social and economic history of Upper Palaeolithic Levantine foragers, we will briefly outline the palaeoclimatic conditions that determined in this region the availability and distribution of animal and plant food sources. Currently the detailed terrestrial records derive from the study of speleothems that reflect the relative amounts of annual precipitation (Bar-Matthews *et al.* 1999, 2002; Bar-Matthews and Ayalon 2003). Additional evidence

is retrieved from the study of marine and lake pollen cores (*e.g.*, Weinstein-Evron 1990; Rossignol-Strick 1995; Robinson *et al.* 2006; Enzel *et al.* 2008). In the Mediterranean phytogeographic belt the annual rains and their distributions through the cold winter months were the major factor, more so than temperature fluctuations, that determined the spatial distribution of the forests, parklands and steppic plant associations.

The ^{18}O record from Soreq cave is reasonably detailed. Several cycles were recognized in the original study (Bar-Matthews and Ayalon 2003), their ages are calendar and their interpretation exhibits transitions from cold and dry conditions to wet and warm ones within various timespans. Assuming that the onset of the Upper Palaeolithic began around 50/48 ka cal BP (dates calibrated by CalPal), the following ^{18}O phases were recognized and translated to estimated annual rainfall (Bar-Matthews and Ayalon 2003):

- Phase I (54.5–49.5 ka) was warm and wet, fluctuating between 300–600 mm;
- Phase H (49.5–46 ka) was essentially a cold and dry period (began with a dramatic decrease to 200 mm, but increased to fluctuate between 300–600 mm);
- Phase G (46–36 ka) was a long period of stable cold climate;
- Phase F (36–35 ka) had a short climatic fluctuation from cold and dry to warm and an immediate return to cold;
- Phase E (35–34 ka) had a short climatic fluctuation mainly cold and dry. Both this phase and the previous one (F) indicate a major, abrupt, fluctuation from *c.* 250 to 500 mm;
- Phase D (34–25.5 ka) was cold, with fluctuating frequencies of precipitation;
- Phase C (25.5–18.5 ka) is the time of the Last Glacial Maximum (MIS 2).

It should be noted that there are certain disagreements between Bar-Matthews and her associates and other researchers (*e.g.*, Frumkin *et al.* 1999, 2000; Kolodny *et al.* 2005). The main issue is the proposal that the ^{18}O ratios portray only the source of the rain water in the Mediterranean Sea basin and don't indicate the local annual amount of rain. These reservations emanate from correlations between the Jerusalem speleothems and the Lisan Lake deposits and indicate overall wetter conditions in the course of the Last Glacial with peaks during MIS 4 and 2 (LGM). As the span of the Upper Palaeolithic discussed in this paper is post-MIS 4 and ends during the LGM, there seems no contradiction between the above mentioned rain estimates and the reservations detailed above.

A rapid rainfall increase after the LGM is recorded in other data such as the pollen sequences from the Hula Valley and the Ghab (van Zeist and Bottema 1991; Baruch and Bottema 1999). Unfortunately difficulties with the dating of these cores do not allow for detailed correlations with the speleothems but the general impression is that fluctuations of annual precipitation over many centuries are expressed in the variable ratios of arboreal pollen versus that of the *Artemisia* sp. In general, it should be remembered that the western reaches of the Levant, the coastal plain and the main mountains range that extends from north to south, were always wetter than the Rift Valley (from the Amuq Valley through the Dead Sea) with decreasing precipitation over the eastern plateau of the Syro-Arabian desert.

Finally, a comment on the history of terminology is required. It will facilitate the understanding of how the archaeological observations culminated in the recognition of the cultural entities discussed in the following pages. It will also explain how the currently accepted subdivision in the Levant of the time-range from *c.* 50/48 to 11.5 ka cal BP into two parts had come about. The general period called in Europe "Upper Palaeolithic" incorporates in the Levant two chronological units, namely, the Upper Palaeolithic and the Epipalaeolithic.

In Europe where prehistoric research emerged before the use of radiometric dates, the main subdivision of the Palaeolithic era into time-cum-cultural units was made on the basis of the major types of stone tools. Hence the appearance of blade industries above the flake-dominated Middle Palaeolithic assemblages heralded the onset of the Upper Palaeolithic. During the late 19th and early 20th centuries European researchers recognized the emergence of microlithic industries and named them 'Mesolithic' in order to differentiate them from the preceding Upper Palaeolithic and the proceeding Neolithic phenomena. Eventually, the Mesolithic industries in western Europe were chronologically assigned to the post-Glacial – early Holocene time slot.

French prehistorians working in North Africa uncovered rich microlithic industries (the majority assigned to the

Iberomaurusian tradition) and due to the lack of radiocarbon dates relegated them to the end of the Palaeolithic period, coining the term 'Epipalaeolithic'. In the Levant, the first microlithic industry was discovered by D. Garrod who named it the 'Natufian', attributed according to her European background to the post-Palaeolithic, *i.e.*, the Mesolithic. Research during the 1960s of microlithic industries earlier than the Natufian, still with no radiometric dates, caused the replacement of the term 'Mesolithic' by the term 'Epipalaeolithic'. Once the microlith-dominated assemblages were radiocarbon dated it became obvious that the "Epipalaeolithic" period began around 20 ka cal BP and is actually contemporary with about half of the length of time of the European Upper Palaeolithic. Hence, if we follow the model of the Levant and apply it to the European prehistory, chronologically, the Epipalaeolithic timespan would incorporate the Solutrean, Magdalenian, Azilian and other contemporary archaeological entities all across Europe. Perhaps the time is ripe to abandon these 19th century terms and move to radiometrical chronological determinations of regional cultural entities all around the Mediterranean basin. However, the present paper is discussing the Levantine Upper Palaeolithic as it has been traditionally defined, from *c.* 50–20 ka cal BP (calibrated by CalPal), using the currently accepted terminology. We first describe the characteristics of the cultural entities, based mostly on their lithic component but also the worked bone and antler assemblages, and then present the evidence for subsistence gauged mainly from the animal bone remains. A short description of the rare human relics will follow.

The transition from the Middle to the Upper Palaeolithic

This "transitional phase" is often the cause of disagreements among scholars, stemming, in our view, from fuzzy archaeological terminologies, disregard of the meaning of what constitute 'learned behaviour' in traditional societies, and certain ambiguities in the interpretation of radiocarbon chronology within the range of 50–40 ka BP. However we will use the basic information gathered from old and recent excavations across the Levant to achieve a balanced overview, of sorts, stressing both the paucity of information as much as the observations that can serve as secure foundations for future research.

In order to avoid barren discussions on what constitutes 'cultural change' we follow the original contention that it is the lithic typological change which determines a cultural change. This means that the emergence of the Upper Palaeolithic is reflected through the dominance of end-scrapers, burins, and blade forms (including points and backed pieces) over the characteristic late Middle Palaeolithic tool types such as sidescrapers and flake points. In addition, the term 'transition' actually implies some sort of

cultural continuity as if the first Upper Palaeolithic industry emerged from a Mousterian background, comprising quite a large number of lithic elements and technological attributes of the preceding Middle Palaeolithic cultural entities.

Currently, there are two hypotheses concerning the emergence of the earliest Upper Palaeolithic in the Levant. The first derives from the study of the lithics and suggests we should consider the change as a gradual shift from the Middle Palaeolithic assemblages dominated by the Levallois methods unto a blade industry that still comprises several of the technological features of the former industries.

The second hypothesis derives its support from the genetic evidence concerning the origins of modern humans in Africa and their expansion through the Levant into Europe (e.g., Olivieri *et al.* 2006). Assuming that the bearers of this type of Initial Upper Palaeolithic (IUP) had moved relatively fast across land masses, the presence of such an IUP industry in many localities along their route, hundreds of kilometres away from the original 'core area', could be falsely interpreted as "endemic evolution". The tempo of the migrating people on a continental scale is partially revealed as secure radiocarbon dating for the span of 50–40 ka BP is being obtained from several key sites (e.g., Mellars 2006; Bar-Yosef 2007). The cultural techno-typological change is more easily recognized when we compare the variable components of the local Late Middle Palaeolithic with those of the IUP in each region. An amazing long-distance similarity was found between the Boker Tachtit assemblages in the Negev, those from the early Upper Palaeolithic layers at Ksar 'Akil and the Bohunician entity in Moravia (Svoboda and Skrdla 1995; Svoboda and Bar-Yosef 2003 and papers therein; Tostevin 2003).

The information concerning Late Middle and Early Upper Palaeolithic cultures in the Levant, as well as in the Zagros mountains was provided in several publications (Bar-Yosef and Pilbeam 2000 and papers therein; Goring-Morris and Belfer-Cohen 2003 and papers therein; Bar-Yosef 2007 and references therein). These data form the base of the summary offered here concerning the Levantine Upper Palaeolithic from c. 50–45 ka cal BP through c. 20 ka cal BP. For clarity we have rounded the available calibrated dates, and readers interested in the fine details should consult the original publications cited herein.

The Levantine Initial Upper Palaeolithic

Historically, the Middle and Upper Palaeolithic entities were first described on the basis of the stratigraphic sequences at the caves of el-Wad in Mt. Carmel (Garrod and Bate 1937) and those of et-Tabban and Erq el-Ahmar in the Judean desert, with some additional information from Qafzeh cave (Neuville 1951; see Fig. 9.1). The cultural scheme, from what in Garrod's days was called 'Levallois-Mousterian' (Middle Palaeolithic) through the 'Aurignacian' (Upper Palaeolithic), was based on broad similarities with European

examples. The Levantine research pioneers considered the lithic assemblages of the Early Upper Palaeolithic as composed of both Mousterian elements (e.g., Levallois products, sidescrapers), and new tool types heralding the fully fledged Upper Palaeolithic "cultures" (e.g., blades, endscrapers and burins). Later studies by Copeland (1975) led her to suggest that the typological change from the Middle to the Upper Palaeolithic involved the use of blanks produced by Levallois technique.

Garrod (1955), who reclassified Turville-Petre's finds from the Emireh cave, suggested labelling the first post-Mousterian entity from both this cave and el-Wad layer E as the 'Emiran' (while Neuville, who advocated a linear evolution, considered this industry as 'Upper Palaeolithic Phase I' in his six-partite scheme). Reassessment of the long sequence of Ksar 'Akil resulted, among other, in coining the term "Transitional Industry". It applied to assemblages deriving from layers overlying the Mousterian ones which had displayed both, Upper Palaeolithic typology and some Middle Palaeolithic technology (Copeland 1975; Azoury 1986; Ohnuma 1988). The notion of 'transitional' characteristics was reinforced with the excavations at Boker Tachtit in the Negev highlands (Marks 1983, 1993), where morphologically Mousterian artefacts (*i.e.*, Levallois points) were produced by Upper Palaeolithic bidirectional blade technology with various tool types (presented in schematic drawings in Fig. 9.2). Hence, the term "Transitional Industry" implied a local cultural transition from the Levantine Middle Palaeolithic unto the Upper Palaeolithic. This conclusion has biological implications as well. Currently, the Late Mousterian (or late Middle Palaeolithic) in the Levant seems to have been produced by Near Eastern Neanderthals (see Shea, Chapter 8). Thus, continuity in the realm of lithic production could also mean a biological continuity that would bring us back to the time when modern humans (presumably the makers of Early Upper Palaeolithic industries) were considered as the descendents of the local Neanderthals, an assumption that should be treated rather cautiously (but see Arensburg and Belfer-Cohen 1998).

Examining the entire set of known Levantine IUP industries (see sites in Fig. 9.1) indicates that there were at least two different provinces in this region. In the northern one chamfered blades and flakes – the *chanfreins* – characterized the appropriate layers in Ksar 'Akil and Abri Antelias (Newcomer 1970). The active edge of the chamfered pieces was shaped by a side blow, on the retouched end of the piece, forming a rounded edge that is assumed to have served as a scraper (Newcomer 1970; Fig. 9.2, 5). It should be noted that the chamfered tool type is common in the Haua Fteah cave, Cyrenaica (Libya), in the Dabban layers, the local IUP culture at that site (McBurney 1967; Garcea, Chapter 5). It was found also in Nag 'Hammadi in Egypt – an undated open-air site (McBurney 1967; Vermeersch, Chapter 7). The absence of chamfered pieces from stratified

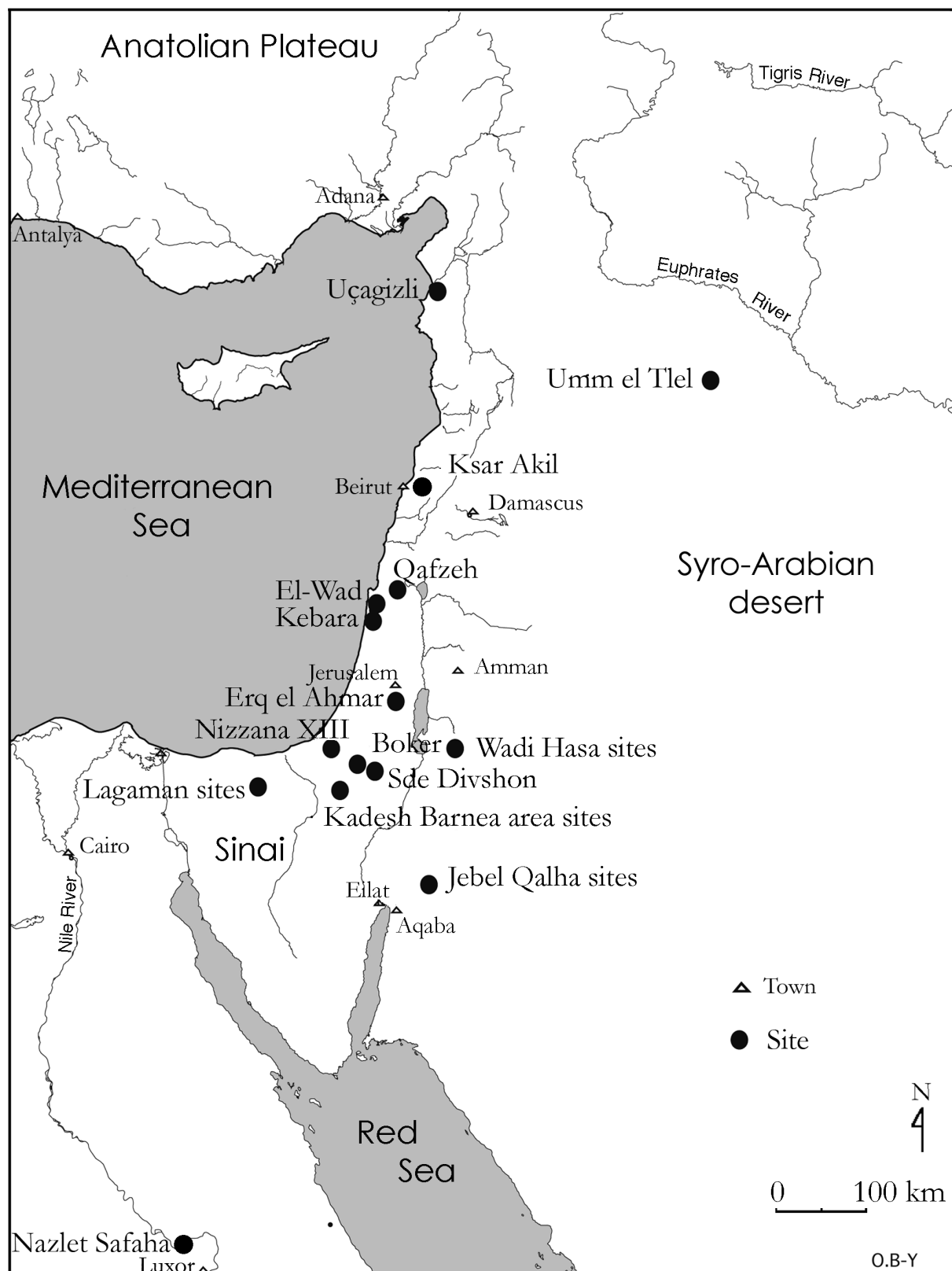


Figure 9.1. Distribution map of Levantine IUP and Early Ahmarian sites.

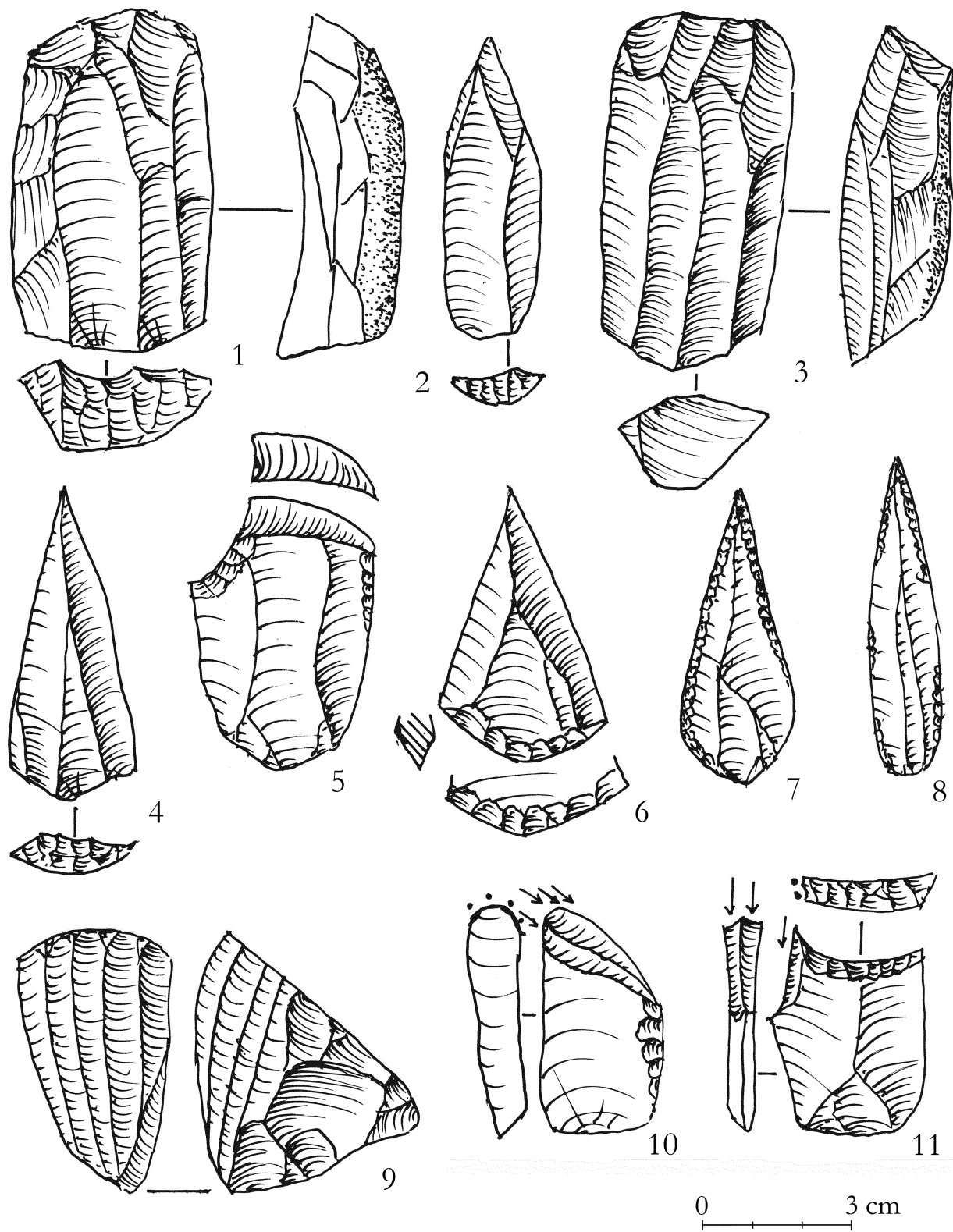


Figure 9.2. Schematic drawings of Early Upper Palaeolithic cores and tool types: 1. IUP blade core; 2. IUP blade with faceted platform; 3. Opposed platform blade core; 4. Umm et-Tleil point; 5. Chamfered flake; 6. Emireh point; 7. Ksar Akil point; 8. el-Wad point; 9. Carinated core (Late Ahmarian); 10. Carinated (twisted) core on a thick flake; 11. Burin on a truncation ("Atlitian").

sites in the southern Levant is intriguing and only one surface assemblage was collected in the Negev (Goring-Morris and Rosen 1989).

Emireh points (Fig. 9.2, 6), though not in great numbers, characterize the other known variant of IUP industries, known mostly from southern Levant, including surface finds in Lebanon where they overlap with the chamfered elements (Copeland 2001). In particular these points are well-represented at Boker Tachtit, Levels 1 and 2, where their dates fall in the range of *c.* 50 ka cal BP (Volkman and Kaufman 1983). A certain chronological confidence is provided by the sequence of both TL and radiocarbon dates from Kebara cave, where the Emireh industry is missing and the dates for the Upper Palaeolithic Early Ahmarian are 47–45 ka cal BP (Bar-Yosef *et al.* 1996).

Ksar 'Akil is ultimately the most important site known to-date in the Levant, with 18 m of deposits dating from the IUP (from *c.* 50/48 ka cal BP to *c.* 22 ka cal BP (Mellars and Tixier 1989). While the lowermost assemblages (layers XXV–XXIV) are rather poor in artefacts, they clearly demonstrate opposed platform cores with parallel sides (Fig. 9.2, 3), one of the attributes of a major change in volumetric concept (Ohnuma 1988; Ohnuma and Bergman 1990; Meignen and Bar-Yosef 2002) attributed to the onset of the Upper Palaeolithic period.

The assemblages above (layers XXIII–XXI/XX), present triangularly shaped cores which produced convergent blades and Levallois points. Ohnuma and Bergman (1990, 2002), who described the industry, state that “the Levallois points in levels XXIII–XXI/XX are far more numerous than Levallois cores probably because many of them were detached from prismatic cores during continuous production of blades”. They draw this conclusion by taking into account also the Boker Tachtit evidence (Marks 1983, 1993; Volkman 1983), where the refitted cores demonstrated the change in the knappers' conception of the nodule's volume. The Levallois points in Boker Tachtit were shaped by bidirectional removals and their scar pattern is called the “Y-pattern”, different from the local convergent Late Mousterian Levallois points (*e.g.*, Meignen and Bar-Yosef 1991; Kerry and Henry 2000). This raises the issue whether they should be called “Levallois points”, but the discussion of the principles of typological determinations is beyond the scope of this paper.

Similar observations concerning the techno-typological attributes of an early Upper Palaeolithic industry uncovered in Tor Sadaf (Wadi Hassa, Jordan) were made by Fox (2003). Although Emireh points were missing from the Tor Sadaf collection, the basic core technology, with blades and elongated triangular blanks with faceted platforms (referred to as “Levallois points”) resemble the Ksar 'Akil transitional assemblages.

These observations also pertain to the question of function. Levallois points were shown to serve as spear

points (Shea 2006 and references therein). One may wonder if the IUP artisans continued to produce Levallois points for the same purpose. If the answer is a positive one it would mean that thrusting spears were still in use and probably preceded the introduction of spear throwers (*e.g.*, *atlatl*, see Bar-Yosef 1994, 2002; Knecht 1997 and papers therein). Undoubtedly, the production of an old tool form through a new core-reduction strategy testifies for continuity. However, whether spear throwers first appeared in the local Late Mousterian (Copeland 1975) or the idea was borrowed from a neighbouring population, is yet unknown. Blade production that became a marker of the IUP industries, together with the production of triangular points, was observed in the Nile Valley Mousterian (*e.g.*, Taramsa, Van Peer 1998, 2004; Vermeersch 2001). If this hypothesis is accepted as a correlate to the genetic evidence for a ‘wave of advance’ of new people from Africa (Olivieri *et al.* 2006) better dated Late Mousterian and IUP sequences in the Nile Valley are urgently required.

IUP assemblages were uncovered also in south-east Turkey, at the coastal sites of Üçagizli and Kanal caves (Fig. 9.1). The assemblages are blade-based, with faceted striking platforms, and the tool types comprise the so-called Umm el Tlel points, a few chamfered pieces, endscrapers, burins and retouched blades (Kuhn 2002, 2004a, 2004b; Kuhn *et al.* 2004b). Noteworthy are the shell beads made of marine molluscs found in Üçagizli, similar to those reported from IUP layers at Ksar 'Akil (Kuhn *et al.* 2001).

An additional IUP site situated in the el-Kowm basin (north-east Syria), part of the steppic belt of the Levant, is Umm el Tlel. Layers II Base and III 2A, overlying a long Mousterian sequence, are characterized by a *chaîne opératoire* that follows the Levallois concept (Boëda and Muhesen 1993; Bourguignon 1996, 1998). Many of the cores are volumetrically flat, producing numerous blades, which mostly resemble narrow and elongated Levallois points, with unidirectional scar patterns. These points, as well as pointed blades, are named Umm el Tlel points. They resemble the items from Tor Sadaf in southern Jordan mentioned above. The Umm el Tlel points grade into regular blades thus marking the technical change at the beginning of the Upper Palaeolithic. Other products, in particular the retouched pieces, are of a pronounced Upper Palaeolithic character, with numerous burins and endscrapers. Similarly to other IUP assemblages, one finds in these layers some Middle Palaeolithic elements such as the Nahr Ibrahim technique, notches and denticulates. The AMS date of 39 ka cal BP and a TL date of 36 ka for III2A seem to be a little too late for the IUP timespan and more dates are needed before the final chronological assignment of this industry will be affirmed.

In sum, the dating of the MP/UP transition in the Levant is currently based on the TL readings for the latest Mousterian and the earliest radiocarbon dates for the IUP

assemblages (for a comprehensive list of the latter see Appendix in Goring-Morris and Belfer-Cohen 2003, used in this paper as cal BP calculated by CalPal).

The Ahmarian

The Ahmarian tradition was first defined by Gilead (1981, 1991) and Marks (1981) when Upper Palaeolithic blade/bladelet assemblages were recognized to be different from the Levantine Aurignacian, the traditionally all-encompassing Upper Palaeolithic entity defined in the Levant by Garrod (1955) and Neuville (1951). Actually, Neuville (1951) had some qualms about this linear scheme while he excavated the Erq el-Ahmar rockshelter (Fig. 9.1). Layers B through F demonstrated the production of blades which exceeded that of flakes. Copeland (1976) noted the rarity or absence of carinated and nosed scrapers, hallmarks of typical Aurignacian, and one of the original criteria of its recognition as an archaeological entity and thus the notion of a non-Aurignacian entity was accepted (Gilead 1991).

The Ahmarian was later subdivided into an Early (38/37–28/27 ka cal BP or *c.* 45–30 ka cal BP) and a Late phase (*c.* 28/27–20 ka cal BP or *c.* 30–23/22 ka cal BP). The Early Ahmarian assemblages are characterized by the production of blades from fully-fledged blade core reduction strategies of prismatic cores with one or two platforms (Fig. 9.2, 1, 3). Retouched pieces include the early manifestations of el-Wad points (Fig. 9.2, 8), as well as a type with ventral retouch (Boker A, Monigal 2003). There are varying frequencies of endscrapers and sometimes burins, often shaped on flakes (including cortical ones), that accompany the blade production.

Most of these assemblages were retrieved through systematic excavations, and the earliest among them contain blades with faceted striking platforms reminiscent of IUP contexts such as Ksar 'Akil layers XXV–XXI, that continue to appear in layers XX/XIX–XVII/XVI (Azoury 1986; Ohnuma 1988) in which two special points named *pointe à face plane* and Ksar 'Akil point by Azoury (1986) and Copeland (1975; see Fig. 9.2, 2, 7) were found. Similar blades with faceted platforms were encountered in Kebara units IV–III (at *c.* 47–45/40 ka cal BP, Bar-Yosef *et al.* 1996). Among other Early Ahmarian sites with a full production of blades are Uçagizli (Kuhn *et al.* 2004b, 2009), Boker A (*c.* 41 ka cal BP, Monigal 2003) and Boker Tachtit Level 4 (Marks 1983, 1993), the Lagaman sites (Bar-Yosef and Belfer 1977), Qadesh Barnea (Gilead and Bar-Yosef 1993) and Abu Noshra (Phillips 1988, 1994; Becker 1999) in Sinai, and several sites in Jordan (Coinman and Henry 1995) that, though undated, produced similar assemblages, such as Tor Sadaf layer B (Coinman 2003; Fox 2003). The site of Nahal Nizzana XIII provides an excellent demonstration of a reconstruction through refitting of such an early Ahmarian reduction sequence (Goring-Morris and Davidzon 2006).

It should be remembered that the Early Ahmarian lasted several thousand years from approximately 47/45 ka cal BP until the arrival of the Levantine Aurignacian at about 35/34 ka cal BP. The latter entity (described below) represents a penetration from the north and is absent in the steppic semi-arid belt, thus in regions such as the Negev and Sinai there was probably no break between the Early and the Late Ahmarian. The major tool groups in this steppic area comprise retouched and backed blades as well as el-Wad points. Endscrapers are present, but burins are rare. There is definitely a high degree of typological variability among sites that were assigned to the Early Ahmarian. One example is the cluster of occurrences in Gebel Maghara, northern Sinai, dated to 38–44 ka cal BP, named 'Lagaman' (Bar-Yosef and Belfer 1977), or those excavated in Qadesh Barnea (Gilead and Bar-Yosef 1993).

The Early Upper Palaeolithic (EUP) sites in the Mediterranean belt were quite numerous including the site of Ksar 'Akil, where we have the only modern *Homo sapiens* burial recovered in the Levant. 'Egbert' was the nickname given to skeletal remains, including a skull, exposed in layer XVII (Bergman and Stringer 1989).

The nature of EUP sites in the steppic belt is ephemeral and suggests that these were temporary camps of mobile foragers. It seems that their social, economic and cultural frameworks were entirely different from those of the Late Mousterian. The larger exploitable territories of these EUP hunter-gatherers would have required improved communication systems in order to maintain contact with other groups and to ensure that their mating networks remained viable.

The Aurignacian

The Levantine Aurignacian is known only from cave sites (Fig. 9.3). Open-air sites are as yet not known in the Levant, which raises issues of territoriality, preservation, and visibility (*e.g.*, sites buried under the alluvium), that are often ignored, but should serve as worthy topics for future research.

The Levantine Aurignacian was originally defined on the basis of the same typological criteria as in Europe, namely frequencies of nosed and carinated scrapers, which often outnumber burins, the presence of Dufour bladelets, and the el-Wad points (originally correlated by Garrod with the French Font Yves point and later with the central European Krems point) (Fig. 9.4). It was actually suggested by Garrod (1957) that the el-Wad points are the local contribution to the incoming Aurignacian and indeed they are much more frequent in the Ahmarian industries, such as the Lagaman in northern Sinai. There is a wide range of morphological variability among the el-Wad points. The retouch on both edges could be fine to semi-abrupt, and probably reshaped the basic blade or bladelet blanks. The retouch is rarely

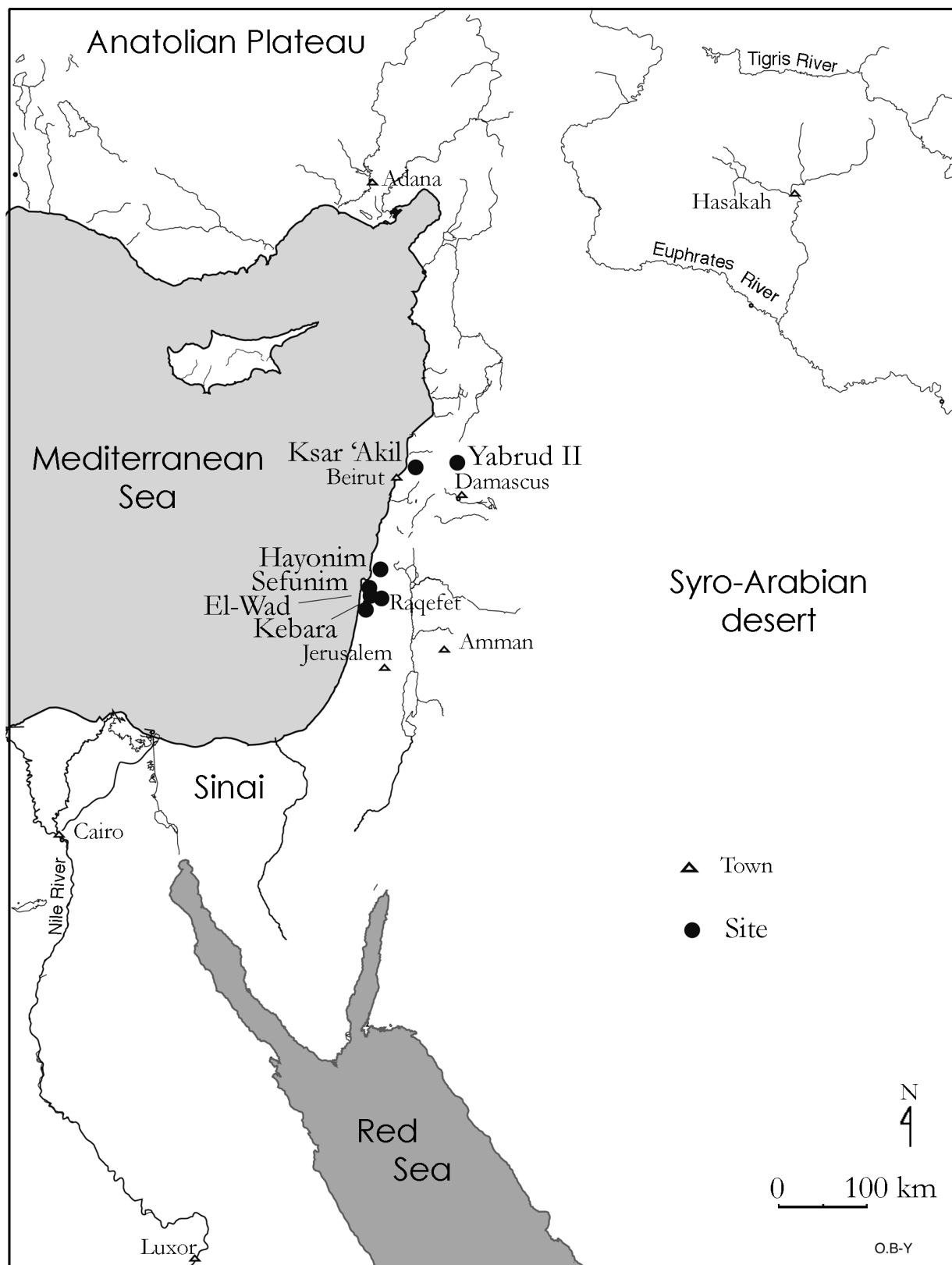


Figure 9.3. Distribution map of Aurignacian sites in the Levant.

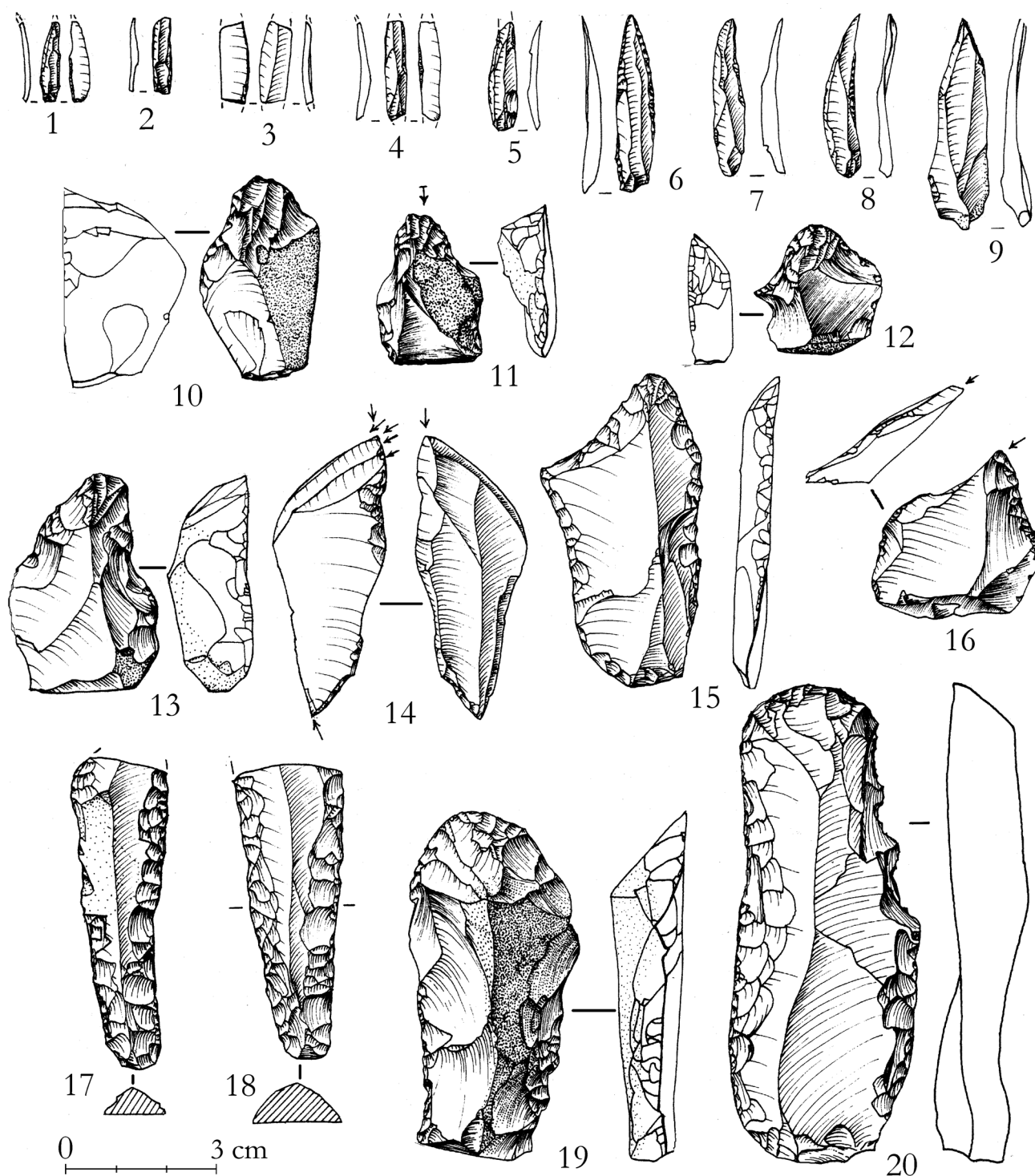


Figure 9.4. A selection of stone Aurignacian artefacts (after Belfer-Cohen and Bar-Yosef 1981): 1–9. Dufour bladelets; 10–12, 15. Carinated and nosed endscrapers; 14. Carinated burin; 16. Burin on truncation; 17–18. Aurignacian blades; 19–20. Endscrapers on retouched blades.

abrupt (Bergman 1981). Most probably the points served as projectiles (Bergman and Newcomer 1983). We should also stress that the presence of the microlithic Dufour bladelets was noticed only when careful sieving was practiced. The Levantine Aurignacian entity was relatively rich in bone and antler tools as compared with preceding or succeeding entities. Two split-base points, the hallmark of the Early Aurignacian in western Europe, were reported from Kebara and Hayonim caves (Bar-Yosef and Belfer-Cohen 1996; Belfer-Cohen and Bar-Yosef 1999) (Fig. 9.5, 12–13).

A note on the issue of terminology is required, as in the 1970s a definition of the ‘Levantine Aurignacian’ was coined on the basis of the Ksar ‘Akil sequence. The early phase, ‘Levantine Aurignacian A’ (layers XIII–XI), was followed by the ‘Levantine Aurignacian B’ (layers X–VIII), while the ‘Levantine Aurignacian C’ was defined on the basis of the assemblages of layers VII–VI (Copeland 1975; Azoury 1986; Bergman 1987; Bergman and Goring-Morris 1987). Techno-typological studies of the so-called ‘Levantine Aurignacian C’, which became synonym of the earlier denomination of ‘Atlitian’ recognized by Garrod in el-Wad layer C (Garrod and Bate 1937) demonstrated that the elevated percentages of simple flake scrapers and burins clearly lack the Aurignacian characteristics and should not be included in the Levantine Aurignacian (Belfer-Cohen and Goring-Morris 2003; Williams 2003; Goring-Morris and Belfer-Cohen 2006).

From a cursory overview, there is undoubtedly a dichotomy between Upper Palaeolithic flake-dominated and blade-dominated industries in the Levant that led Gilead (1981) and Marks (1981) to recognize two contemporaneous technological traditions (see Ronen 1976). This schematic view was held, until recently, by most scholars in the Near East. However, with time it became apparent that the enfolding picture of the Levantine Upper Palaeolithic is more complex. One should take into consideration not only the core reduction strategies, but also the typological variability; tool blank preferences as well as the presence and types of bone and antler artefacts. Although the detailed sequence of the Levantine Aurignacian was not yet examined in depth, we note that in Kebara cave, an assemblage similar to the ‘Levantine Aurignacian A’ of Ksar ‘Akil was identified in Units I–II, overlaying Early Ahmarian assemblages (Bar-Yosef *et al.* 1996; Bar-Yosef and Belfer-Cohen 1996). These ‘Aurignacian’ assemblages are characterized by a mixed industry of flake and blades, with carinated and nosed endscrapers, retouched Dufour bladelets, and one split-base point, a European guide fossil of the Aurignacian I. A similar lithic assemblage was reported from Hayonim cave (layer D). There was also quite a rich worked bone and antler industry including yet another split-base point. A unique find were two engraved limestone slabs. One bears a series of fine incisions and the other depicts an incised horse (Belfer-Cohen and Bar-Yosef 1981; Marshack 1997).

The few dates of the Levantine Aurignacian range between *c.* 36/34–28/27 ka cal BP (Bar-Yosef *et al.* 1996; Lengyel *et al.* 2006), but probably additional dates will shorten this timespan. Our cautious estimate is 32–30/29 ka cal BP, but this should be confirmed by future dating. When compared to the long persistence of the laminar Ahmarian industries in the region (42/38–18 ka cal BP), the Levantine Aurignacian *sensu stricto* is a short-lived archaeological phenomenon. It justifies earlier proposals (*e.g.*, Kozłowski 1992) to interpret the presence of the Aurignacian in the Levant as evidence for a small population migrating from south-eastern Europe (and possibly Anatolia) into the Levant. The bearers of this industry survived only in the Mediterranean vegetational belt and did not dare to penetrate into the steppic lands where the makers of other industries were present, as for example Late Ahmarian ones. This observation lends further support to the proposal to see the classical Aurignacian as a culture that developed in western Europe and not in the eastern Mediterranean, the Zagros, the Caucasus, or Central Asia (Bar-Yosef 2000) as suggested by others (Kozłowski and Otte 2000; Olszewski and Dibble 2006; Otte and Kozłowski 2007).

In sum, Aurignacian assemblages, similar to those known from western Europe, were recovered from cave and rockshelter contexts, such as Ksar ‘Akil, Hayonim, el-Wad, Kebara, Sefunim, Yabrud II, and Rakefet (Bar-Yosef and Belfer-Cohen 1996; Belfer-Cohen and Goring-Morris 2003, 2007; Goring-Morris and Belfer-Cohen 2006; Lengyel *et al.* 2006). We should stress that these assemblages include bone and antler tools with at least two split-base points, and pendants made of deer teeth. The two incised slabs from Hayonim cave should be added to the list of cultural traits that make the correlation between the Levantine Aurignacian and its European ‘mother’ culture a sound one.

The Late Ahmarian and the flake dominated industries

The stratigraphy of Ksar ‘Akil and radiocarbon dates for the blade/bladelet industries of post-Aurignacian age indicate that there could have been a period of contemporaneity in the Levant between assemblages assigned to the Late Ahmarian and others, dominated by flakes, both in the debitage and tool categories (including several of the mistakenly so-called ‘Levantine Aurignacian C’, see Belfer-Cohen and Grosman 2007; and the distribution maps in Figs. 9.6 and 9.7).

Above the Ksar ‘Akil Aurignacian (*i.e.*, layers IX–VIII) there is layer VII with a bladelet industry, overlain by layer VI characterized by flake production and an abundance of burins. A series of layers rich in blades/bladelets dated to 33–31 ka cal BP was excavated in Qafzeh cave, above which there was a very dispersed layer with scanty remains

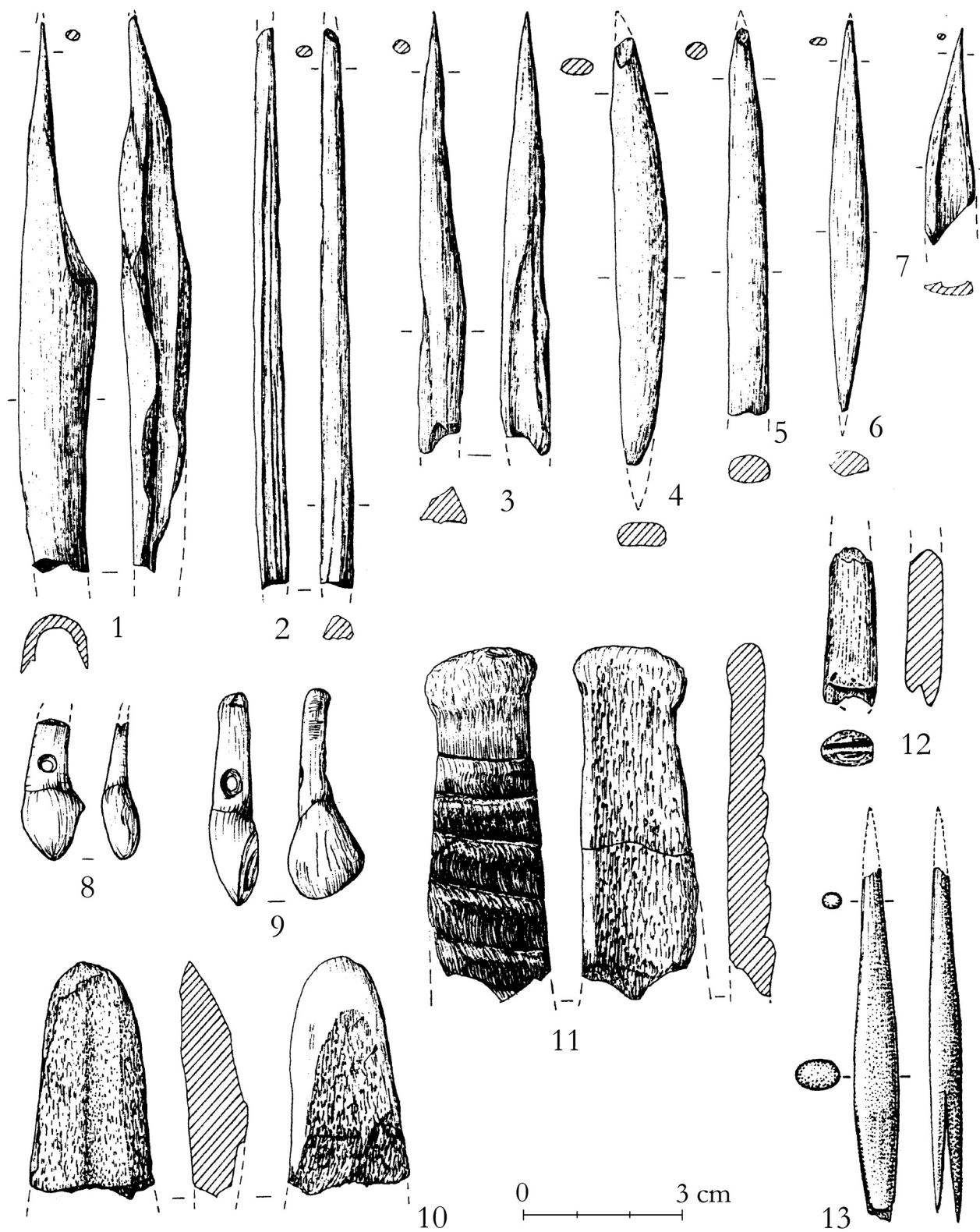


Figure 9.5. A selection of Aurignacian bone and antler tools (after Bar-Yosef in Bar-Yosef and Pilbeam 2000, with permission): 1–3, 7. Points and awls; 4–6. Antler bi-points; 8–9. Pendants from deer teeth; 10. Lissoir; 11. Shaped object; 12–13. Split based points (Provenience: 1–12. Hayonim cave, layer D; 13. Kebara cave, unit I–II).

reminiscent of a flake industry (Bar-Yosef and Belfer-Cohen 2004). Another example with a flake industry is the site of Boker B-E in Nahal Zin (Marks 1983), characterized by a proliferation of scrapers and/or burins with little evidence for the production of bladelets.

Indeed, in the timespan from *c.* 33/30 ka cal BP through *c.* 23/21 ka cal BP, when the Masraqa and the Nebekian, both microlithic entities, herald what is currently called the Epipalaeolithic era, there is plenty of evidence for the presence of both flake assemblages, as well as the blade/bladelet-dominated Late Ahmarian (Belfer-Cohen and Goring-Morris 2003). The penecontemporaneous occupations are interpreted as resulting from movements of groups of foragers into the Levant, although unfortunately not all of these assemblages are radiometrically dated and thus the following description will pertain only to what is known about the lithics.

a. The flake industries

We begin with the stratigraphic evidence from layer VI at Ksar 'Akil that documents the presence of flake industries (rich in burins and some scrapers). Originally, similar assemblages were called 'Atlitian' (Garrod and Bate 1937; Neuville 1951; Echegaray 1964) and were found in the Upper Palaeolithic sequence in el-Wad, and at the base of the Epipalaeolithic sequence of the terrace of el-Khiam in the Judean desert. More recently, sites such as Nahal Ein Gev I and Fazaal IX produced rich tool-kits (Goring-Morris 1980; Belfer-Cohen *et al.* 2004). Most surprising is the lack of bladelet production and the few found are mostly burin spalls from the shaping of numerous burins on truncations or notches that could be redefined as cores according to current thinking (but see Belfer-Cohen and Grosman 2007).

Another "facies" of these flake-dominated assemblages is characterized by laterally carinated items ('scrapers', 'burins' or 'cores?') on thick flakes in Ain Aqev, in the Negev highlands (Marks 1976). However, these items significantly differ from the typical Aurignacian carinated and nosed pieces. Several radiocarbon dates are available for Ain Aqev D31 (*c.* 21/20 ka cal BP).

Most of the other sites lack the desired chronological control and their estimated age could be in order of 30/29–22 ka cal BP (Belfer-Cohen and Goring-Morris 2003). Interestingly, the phytogeographic spread of these assemblages encompasses both the Mediterranean belt (Ksar 'Akil, Fazaal IX, Nahal Ein Gev I), as well as the steppic and semi-arid region of the Negev and northern Sinai (Ramat Matred/Har Lavan, Shunera XV, Har Horeshe I, Arqov/Avdat; Ain Aqev/Boker C, Qadesh Barnea 602, Qseimeh II) (Marks 1976; Larson and Marks 1977; Gilead 1981, 1991; Jones *et al.* 1983; Belfer-Cohen and Goring-Morris 1986; Gilead and Bar-Yosef 1993; Phillips 1994), and other sites in the el-Kowm region (Boëda and Muhesen 1993) (Fig. 9.6).

b. Late Ahmarian

In addition to Ksar 'Akil layer VII and Qafzeh layers 6–11, there is a wealth of recorded assemblages of blade/bladelet sites (Fig. 9.7) such as Megeed rockshelter Unit 3, Ohalo II, Fazaal X, Masaraq el-Na'aj, Nahal Sekher 122, Ein Aqev East (D34), Azariq XIII, Shunera XVI, Lagama X, Wadi Sudr 6, Azraq 17 trench 2, Ain el-Buhira (WHS618), and Yutil el-Hasa (WHS 784) (Ferring 1977; Goring-Morris 1980, 1987; Baruch and Bar-Yosef 1986; Goren and Gilead 1986; Nadel *et al.* 1995; Olszewski 2000; Coinman 2003; Kuhn *et al.* 2004a and references therein).

As mentioned above the current view is that the technotypological attributes of these assemblages indicate a direct continuity from the Early Ahmarian, and hence they were assigned to the Late Ahmarian, dated to *c.* 30–23/22 ka cal BP. Core reduction strategies were aimed at the production of numerous bladelets and fewer blades. The retouched items demonstrate high frequencies of narrow, finely retouched ('Ouchtata') bladelets (Ferring 1988; Goring-Morris 1995; Goring-Morris and Belfer-Cohen 1997). The el-Wad points are missing and no characteristic Aurignacian elements are found. A large number of these assemblages are considered as a "transition" stage unto the Epipalaeolithic. The rich series of 14C dates from Ohalo II centre around 19 ka or 23/22 ka cal BP (Nadel *et al.* 2001).

The continuity in the production of bladelets and their variable types of retouch seem to indicate that the "cultural boundary" between the Upper Palaeolithic and the Epipalaeolithic is actually an artificial subdivision. Hence, the Masraqa (west of the Jordan Valley) was probably a late expression of the Late Ahmarian tradition, while the Nebekian (east of the Jordan Valley) with numerous abruptly retouched bladelets, could have been earlier and contemporaneous with the fully-fledged Epipalaeolithic Kebaran. Thus, a technological shift expressed in abrupt retouching of the bladelets and the eventual appearance of bipolar (*sur enclume*) retouch were important technological markers. While the exact reason for this change is unknown, the assumed role of microliths as components of hunting tools could have been the drive for improvement, a sign of increasing efficiency.

The Epipalaeolithic

The Epipalaeolithic period in the Levant spans the time from *c.* 23/22 through 11.5 ka cal BP. It is through some of its identified cultural entities that we can observe the Terminal Pleistocene increasing demographic pressures (territorial packing) that led to the emergence of sedentism, which became apparent in the Natufian culture (also referred to as Later Epipalaeolithic, at *c.* 14.5 ka to 11.5 ka cal BP; Boyd, Chapter 10). The seeds for the ensuing changes are recorded in the complexity of settlement systems, technotypological variability, subsistence proclivities, and artistic

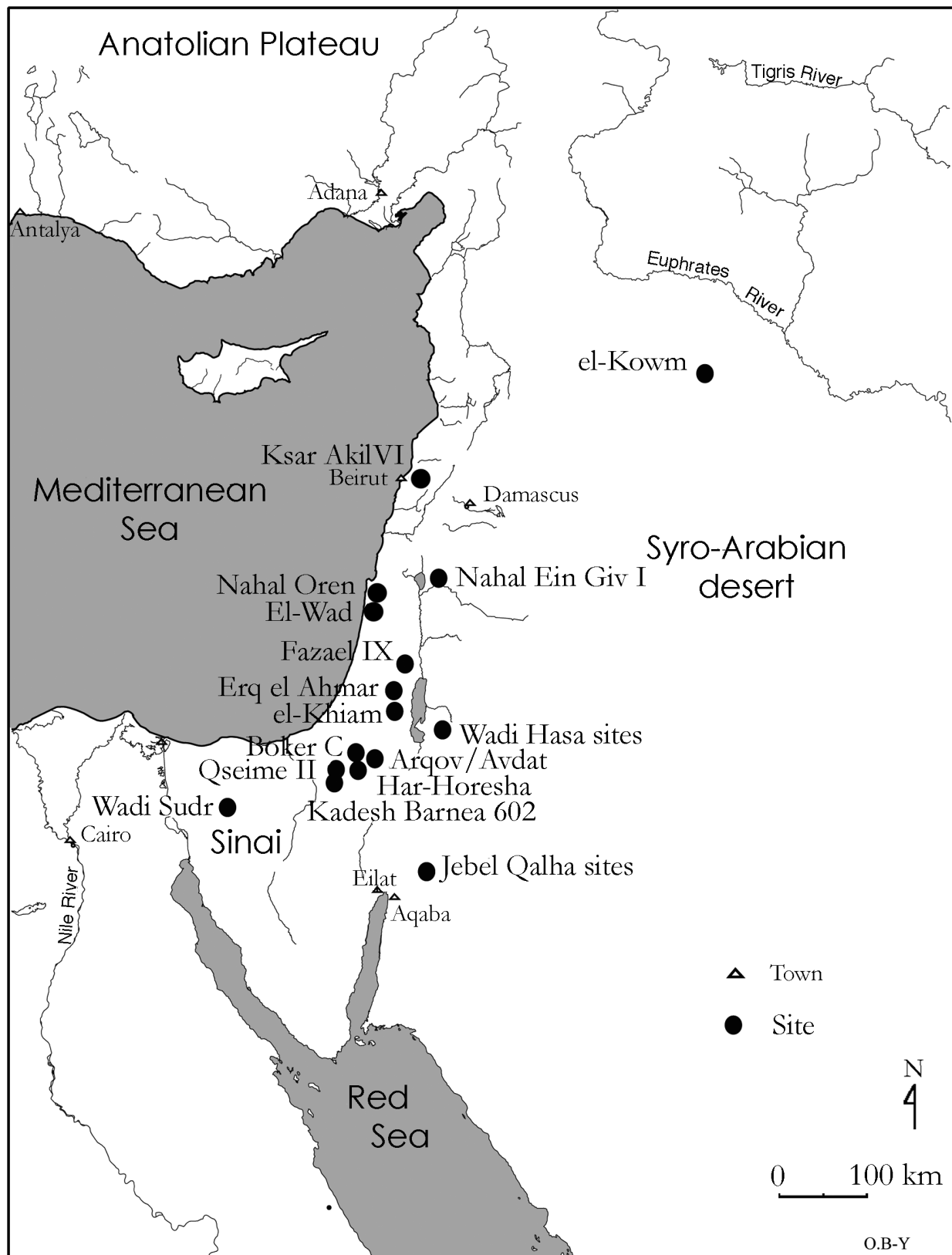


Figure 9.6. Distribution map of selected Flake Industries sites.

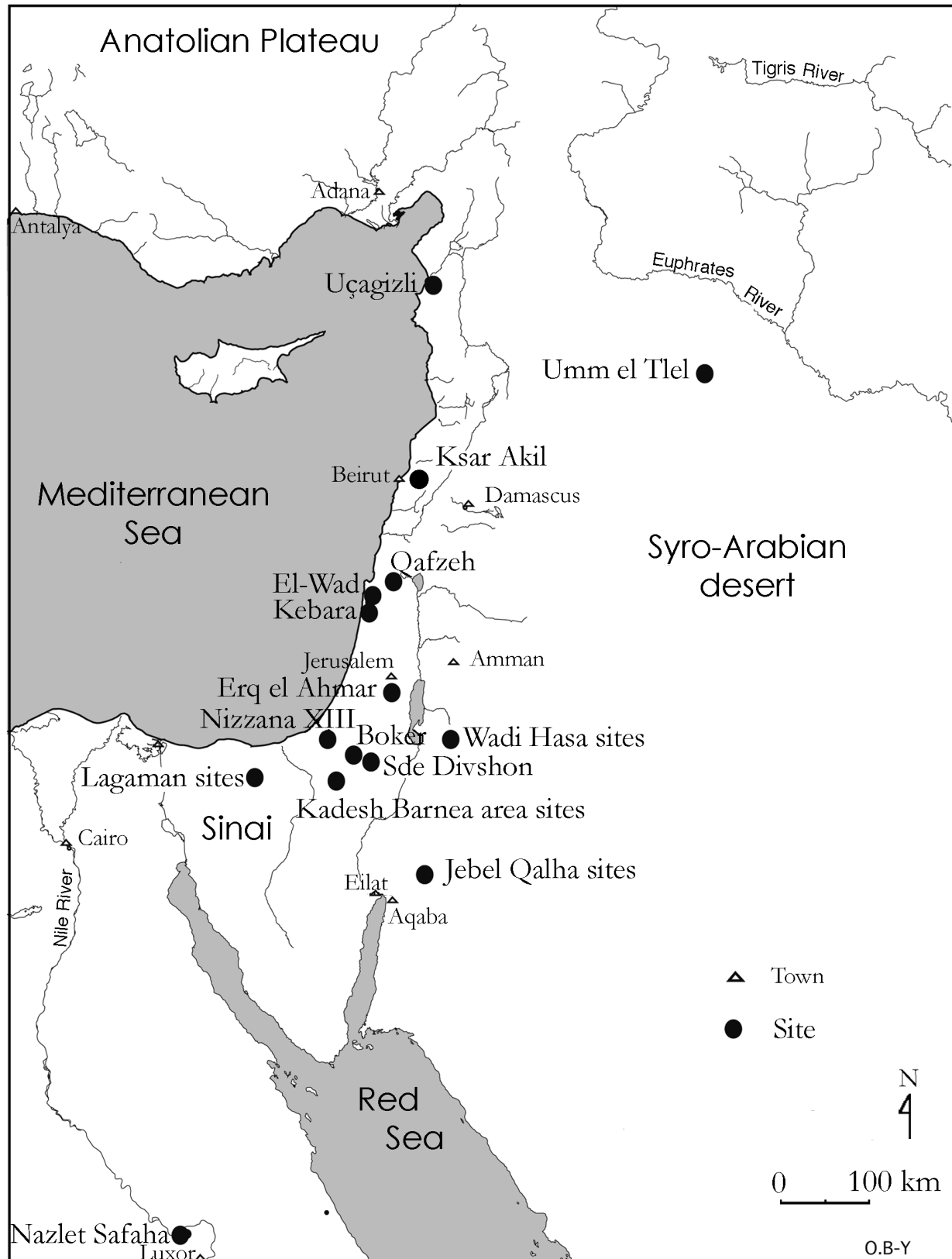


Figure 9.7. Distribution map of selected Late Ahmarian sites.

representations of the so-called Early and Middle Epipalaeolithic that lasted some 6–7 millennia (*c.* 23/24 through 14.5 ka cal BP).

The palaeoclimatic conditions are documented in lake and marine pollen cores, deep sea cores and speleothems. In the southern Levant, the shrinking phases of the Lisan Lake are considered as portraying a general trend towards dryness that was probably caused by slow increase of average annual temperatures and rates of evaporation. Currently, opinions vary about the nature of the Late Glacial Maximum (LGM, *c.* 24–18 ka cal BP) in the Levant, whether it was essentially cold and dry or it was representing continuous pluvial times (Bar-Matthews and Ayalon 2003 *versus* Kolodny *et al.* 2005). Lisan Lake levels record a decrease after 24 ka cal BP and thus support, in part, the cold and dry hypothesis, *e.g.*, the establishment of colder conditions with decreased annual precipitation. However, the average winter rains were still higher than those of the Holocene (Bartov *et al.* 2003). The archaeological entities recognized in the Epipalaeolithic are quite numerous: Mazraqa, Kebaran, Nebekian, Qalkhan, and Nizzanan (Goring-Morris 1995 and references therein), all identified in sites in the Mediterranean area, following more or less today's isohyet of 200 mm that probably was within the 300/400 mm isohyet at that time. This occupational zone also includes the oases in Jordan and the Syro-Arabian desert, where water availability was crucial for both animals and humans. As the climatic conditions continued to improve until the onset of the Younger Dryas (13/12 ka cal BP), the cultural variability of the Early and Middle Epipalaeolithic within the different sub-regions of the Levant proliferated. Various efforts in classification are already published and the reader should consult the detailed reports (*e.g.*, Marks 1976, 1983; Bar-Yosef and Phillips 1977; Goring-Morris 1987, 1995; Garrard and Gebel 1988; Henry 1995; Garrard 1998; al-Nahar 2000; Coinman 2001 and references therein; Olszewski 2001, 2006).

The Epipalaeolithic industries often portray two core reduction strategies. One produced regular blades, while the other employed carinated cores for the production of fine bladelets. In a comprehensive study of some Epipalaeolithic assemblages from the Negev, Goring-Morris and associates (1998) demonstrated that, in spite of the great technical similarity between the different entities, the produced bladelets were shaped into different forms.

The general trend in the shaping of the microliths was a shift through time from finely retouched bladelets, including Ouchtata and inverse retouch, to backing, and later to backed bladelets shaped into geometrics, the first among which were the triangles. Thus, the Early Epipalaeolithic incorporates the Mazraqa, which bridges the Late Ahmarian tradition and is apparent in sites such as Ohalo II with a proliferation of retouched bladelets, and the Nebekian, recognized in the Yabrud III rockshelter, characterized by obliquely truncated

bladelets and the first use of microburin technique for snapping bladelets. The Nebekian resembles the early "facies" of the Kebaran, which is dominated by curved retouched bladelets and Kebara points (obliquely truncated bladelets). The quantitative changes with increasing dominance of Kebara points were observed in the stratified assemblages of Hayonim cave, layer C. Two more specialized entities are the Qalkhan, in Jordan, and the Nizzanan, both employing the microburin technique, while the latter also demonstrates the presence of triangles. It is of interest that the Early Epipalaeolithic, which is a bit fuzzy when trying to pinpoint its beginnings or its end, due to the insufficient number of radiocarbon dates, represents a techno-typological variability much greater than that observed during the next period, the Middle Epipalaeolithic.

The most common assemblages, clearly recognized due to their shared techno-typological attributes, belong to the Geometric Kebaran. Sites of this entity were recorded throughout the entire Levant, from el-Kowm in north-east Syria, and neighbouring areas, to southern Sinai. The characteristic microlithic type is the trapeze-rectangle, a shape that grades from symmetrical rectangles to asymmetrical trapezes (*e.g.*, Goring-Morris 1995).

Excavations in different localities produced a wealth of information about site size and site structure. The larger, richer ones are within the Mediterranean vegetational belt on both sides of the Jordan Rift Valley. Exceptional large sites, often stratified, were found in Jordan such as in wadi Jilat and further south in the Kharaneh area (see detailed account in Garrard and Gebel 1988). These sites produced large collections of animal bones, a few grinding tools, and some shell beads. Smaller sites in the steppe, semi-arid areas were ephemeral occupations. The features in a common small site were a hearth and a spatial spread of artefacts, with occasional grinding tools, as well as some simple bone tools and rare shell beads (*e.g.*, Lagama North VII; see Bar-Yosef and Goring-Morris 1977).

Several burials were discovered in Geometric Kebaran contexts, including Neve David in Mt. Carmel (Kaufman 1987, 1989), Ayn Qasiyah in the Azraq basin (Richter and Maher personal communication), and in the site of 'Uyyun al-Hammam (Maher 2005). In addition in Wadi Mataha, southern Jordan, a burial, which the excavators suggest it belongs to the Geometric Kebaran deposits, was uncovered under the Natufian layer (Stock *et al.* 2005). In all four sites the appearance of burials, whether isolated or a few together, herald the famous Early Natufian cemeteries that date to some centuries later.

Indeed, bone and horn-core tools were rare, as well as ground stone tools (*i.e.*, mortars, pestles and hand-stones), most probably employed in food processing, and crushing ochre for obtaining paint pigments. The use of marine shells for body decoration exhibits a general tendency for Mediterranean species (Bar-Yosef Mayer 2005).

Other groups occupied the steppic-desert region (Goring-Morris 1987, 1995), namely the Mushabian and Ramonian (originally named Late Mushabian, Bar-Yosef and Phillips 1977). Undoubtedly, this period witnessed winter precipitation in the Sinai and Syro-Arabian desert, indicated by the presence of local ponds or temporary lakes such as the one in Gebel Maghara, northern Sinai (Goldberg 1981, 1986). Without food sources one could not explain the proliferation of the microlithic assemblages found everywhere in the Negev, Sinai, and the Syro-Arabian deserts (*e.g.*, Byrd 1998; Garrard 1998; Martin and Garrard 1999; Maher *et al.* 2001; Wright and Garrard 2003). This expansion of the Geometric Kebaran, a Levantine Mediterranean entity, denotes the fact that foragers, in view of improved environmental conditions in the more steppic-desert regions that allowed for the acquisition of reliable, accessible, and predictable food resources, permitted themselves to relax their population control and move into those regions. In fact, this successful entity moved in a relatively short time into the different sub-regions of the Levant. It was only with the invasion of the Mushabians that the Geometric Kebaran had to give up the desert region, and 'retreat' northwards.

The Mushabian is an industry characterized by arch-backed bladelets, often snapped by the microburin technique. The retouched bladelets with the negative scar of the snap are known as La Mouillah points and the snapped-off parts are the microburins themselves. The following entity, the Ramonian, continued the trend of the arch-backed bladelets, the use of the microburin technique, with the addition of the Helwan lunates, thus indicating its contemporaneity with the Early Natufian, which was replacing the Geometric Kebaran in the Mediterranean region of the Levant.

Interestingly, with the dominance of the Early Natufian, which eventually spread over most of the Levant, the amount of techno-typological variability decreased. Actually, the late Epipalaeolithic entities, the Natufian, and the Ramonian share many techno-typological characteristics and the same can be said about the other, rare, non-Natufian occurrences reported from the fringes of the Levantine corridor.

Subsistence

An overall palaeoecological view of the Levant would indicate that the three parallel, north to south (Taurus Mts. to Sinai) oriented vegetational belts (Mediterranean, Irano-Turanian and Saharo-Arabian), together with the topographic variability over short distances (20–50 km), determined the distribution of food resources. These incorporated common edible plant species, game animals, as well as rodents and reptiles (although it is difficult to tell whether they were gathered by humans or by barn owls). The lists and relative quantities of various species of plants and animals (NISP and MNI) reflect the immediate environ-

ment of the sites (5–15/20 km), as well as the acquisition techniques.

When plant remains are available, they could, together with the analysis of animal bones (*e.g.*, the frequencies of young deer or gazelle, indicating spring-summer occupations), record the season of habitation of the sites. Unfortunately, birds cannot in most cases provide the same seasonal information. The midway location of the Levant between Europe and Africa means that migratory species pass through in the course of their annual route, during the autumn and the spring.

In addition, suffice it to mention that most of the mammals in the Levant are Asian and Palaearctic and not of African origin, as the published lists of taxa demonstrate (*e.g.*, Tchernov 1981). The main faunal exchanges between Africa and Eurasia occurred during the Miocene, Pliocene, and possibly during the Lower Pleistocene. There is no evidence for faunal exchanges during the Upper Pleistocene with North Africa (*contra* Tchernov 1998). Differences in the recorded archaeozoological assemblages were the results of species availability in the immediate catchment's area of each site at a given time.

It is well-known that the only site, which provided a rich assemblage of plant remains, is Ohalo II (Kislev *et al.* 1992; Nadel *et al.* 2004; Piperno *et al.* 2004; Weiss *et al.* 2004). The collection of edible plant species includes numerous small seeds but also wild cereals. One can assume that this assemblage may represent a tradition of plant gathering for food that began at a much earlier period. Rare remains of plants from Kebara (Lev *et al.* 2005) and phytoliths from Amud cave (Madella *et al.* 2002) hint to plant exploitation during the Middle Palaeolithic.

An additional line of evidence for food plant processing is the presence of grinding objects (Wright 2000; Belfer-Cohen and Hovers 2005). Among these are the large grinding slab found in Ohalo II (Piperno *et al.* 2004), a smaller grinding slab with handstone uncovered in Qafzeh cave (Ronen and Vandermeersch 1972) which, although smeared with red ochre, could have been used for food preparation. In addition, a basalt block with a cuphole was uncovered in Nahal Ein Gev I (Bar-Yosef 1973). These sites fall within the range of 29–19 ka cal BP and thus extend back in time the appearance of grinding tools as part of the prehistoric cultural tool-kit.

Given the poor preservation conditions of plant remains and charcoal, it is not surprising that the main information concerning food procurement is derived from animal bones (*e.g.*, Garrod and Bate 1937; Hoojier 1961; Tchernov 1981; Garrard 1982, 1998; Stiner 2002; Rabinovich 2003 and references therein; Kuhn *et al.* 2004a, 2004b, 2009; Bar-Oz 2004). It should be remembered that many of the assemblages originate from the excavations of the 1920–30s and the reports are not detailed enough for the requirements of modern archaeozoological inquiries.

During the entire Last Glacial cycle in the Levant, the most common species were spatially distributed according to the local topographic and vegetational zones. Thus, hunting targets represent the availability of large and medium size game in each area within the sub-region with minor shifts from north to south. The Mediterranean vegetational belt of oak and terebinth forests, including the coastal plain (narrow or wide), accommodated three species of deer (fallow deer, red deer and roe deer), boar, cattle, and gazelle (mainly in the south). Bezoar goats were present in the forested highlands but their main concentrations were in the Lebanese mountains and the Taurus foothills in south-eastern Turkey, habitats shared with wild sheep. The latter are not known south of this sub-region. The open parkland areas are generally east of the highland vegetation belt and were the natural environment for Mountain and Persian gazelles, boar, ibex (mainly in cliffy landscapes), onager, and wild ass. In the north, wild cattle roamed in the ecotone of the forests and the open parkland and were more common in the northern Levant than in the south. The semi-arid belt was occupied mainly by gazelles and onagers, and the highlands (e.g., southern Jordan) by bezoar goats and ibex. Ibex and gazelles were also common in the Negev. Bones of fox, hare, and tortoise are found in almost every site, and may portray the attraction to garbage by foxes and the value of their pelts. The hare and the tortoise indicate different hunting and gathering techniques (Stiner and Munro 2002). When examined on the basis of site by site, we recognize environmental differences and also how the vegetational boundaries are no more than schematic approximations. This contention is exemplified by a few samples gathered from the literature mentioned above.

Uçagizli is the northernmost cave along the eastern Mediterranean seaboard which provided well-dated IUP and EUP assemblages. The most abundant species as source of meat (Kuhn *et al.* 2009) are fallow deer, bezoar goat, and roe deer. In addition, wild boar, red deer, and aurochs, or wild cattle were present. The mortality pattern reflects all ages indicating non-selective hunting to prime adult biased age profile as seen in other Upper Palaeolithic sites (Stiner 2005). Both the macrovertebrates and the microvertebrates document the same general environment of cliffy rocky habitat, and forested surroundings.

A similar composition was discovered in Ksar 'Akil (Hooijer 1961) with the dominance of fallow deer, roe deer, and bezoar goats with minimal representation of gazelle and wild cattle. Further south, Kebara cave demonstrates, like el-Wad and Sefunim caves, high frequencies of gazelle and fallow deer together with roe deer and wild cattle. In the latter site, hartebeest (*Alcelaphus*) was identified. Interestingly, in the mid-area between Mt. Carmel and the eastern slopes of the mountains toward the Jordan Valley, the Upper Palaeolithic layers at Qafzeh cave produced the bones of gazelle, red deer, roe deer and fallow deer. The micro-

vertebrates indicate the proximity of the site to the somewhat drier environment of the Jordan Valley that was covered by the Lisan Lake. Closer to Lake Kinneret, the Emireh cave exhibits the same combination of mammals with fallow deer, gazelle, bezoar goat, cattle and equids. The richer environment of open parkland supported red deer and gazelle (Nahal Ein Gev I) and the same two species with wild boar, wild cattle, red deer and bezoar goat were recovered in Ohallo II. Even further south in wadi Fazael sites, fallow deer and gazelle were common. In the Judean desert, el-Quseir and Mazraq en-Naj had the same species, including wild boar and ibex, and so is the case of Erq el Ahmar that lies closer to the watershed.

The differences in mammalian associations are expressed in the steppic, semi-arid belt. Thus, sites in the Syro-Arabian desert, or the eastern reaches of the Jordanian plateau contain the bones of gazelle, wild camel, wild ass, onager, and ibex in the more cliffy-rocky areas (Palmyra oasis, Wadi Jilat, Wadi Hasa, Ras en-Naqeb, etc.). The same holds true for southern Sinai.

Finally, in many sites there are very small samples of carnivores such as hyena, leopard, and foxes. There is no evidence for intensive occupations of hyenas in particular caves. The human presence in the region seems to have been dominant during the Upper Pleistocene, and the changes in the faunal spectrum occurred during the Early Neolithic.

Concluding remarks

From the viewpoint of prehistoric mobile hunter-gatherers, the geographic structure of the Levant, being "elongated" and "box-like", was but a narrow terrestrial corridor connecting Africa and Eurasia. The west-east width of the best exploited areas (plant gathering and hunting) measured from 250 km in the north to about 130 km in the south, with some areas of no more than 80 km across. The planetary position of the Levant, at the junction of two major atmospheric systems, the dominant westerlies and the lesser Indian Ocean monsoon, made it eligible to abrupt disastrous climatic changes (e.g., Bartov *et al.* 2003; Enzel *et al.* 2008 and references therein). Hence, annual, decadal and centennial fluctuations of mostly winter precipitation created periods when steppic vegetation expanded eastward and southward, and times when the availability of food resources was restricted to clearly confined habitats. Under such variable circumstances the region could have accommodated larger or smaller numbers of foragers, serving as either a refugium (leading to "demographic pressure") or permitting population increase and expansion.

Given the role of the Levant as a particular ecological corridor, one may expect to see past social phenomena as we visualize them in a centrally located "bus station". Indeed, the geographic and palaeoclimatic conditions

explain the recorded variability in the lithic industries. There is no doubt that, in a region rich in good raw material within a short distance from every habitable location, the recorded changes in lithic production express different cultural concepts in tool making rather than the impact of environmental changes. The basic techno-typological attributes reflect the accepted chaîne opératoire (or more than one) traditionally held by particular “tribes” (-cum-archaeological cultures).

At the onset of the Upper Palaeolithic, the observed techno-typological variability among IUP assemblages seems to demonstrate a relatively short period of stable cultural facies in the Levant, with the makers of the chamfered pieces located in the north and those who shaped the Emireh points in the south. Yet, within a relatively short time, the whole region became the homeland of the Ahmarian tradition, one basic industry through the entire Levant. The makers of this entity were one of the several groups who carried their lithic techniques into south-eastern and central Europe comprising a “wave of advance” (a term borrowed from Ammerman and Cavalli-Sforza 1984). Those people who preferred the shapes of finely retouched blades and bladelets moved across the Mediterranean lands of southern Europe and were possibly responsible for the so-called “Proto Aurignacian” (e.g., Bon 2002).

In our view, the formation of the Aurignacian entity in western Europe was the result of the impact of new immigrants from the east. Their tool-kits were characterized by carinated and nosed endscrapers, Dufour bladelets, el-Wad (Font Yves) points and the production of particular bone and antler items, personal adornments, and figurines. The western European assemblages seem to portray a dynamic social structure and aggressive behaviour, which became apparent during the second phase of their cultural evolution through the move of some groups into eastern Europe and ‘back’ unto the Levant. It is this migration that splits the continuous stratified sequence of the Ahmarian in the Mediterranean vegetational belt and helps us, the archaeologists, to differentiate between the Early and the Late Ahmarian. However, in the steppic areas, which the Aurignacian foragers avoided, the Ahmarian continued uninterruptedly, although later the same general territory was invaded by the makers of the flake industries, the origin of which remains unknown.

The unfortunately scanty evidence for group size during the first 20,000 years of the Upper Palaeolithic period in the Levant leaves the impression that they were small and mobile, although the degree of mobility is not well-known either for the Early Ahmarian or the Aurignacian.

A similar narrative is offered for the Epipalaeolithic sequence which follows the Upper Palaeolithic one. The earliest complexes, such as the Mazraan, Nebekian and Kebaran are present in the Mediterranean vegetational belt and the oases, while the improved climatic conditions

facilitated the expansion of the following Geometric Kebaran across the entire Levant from the el-Kowm basin through southern Sinai (c. 23/22–17/16.5 ka cal BP). It is generally agreed that core reduction strategies and the production of bladelets (shaped into different types of microliths) demonstrate a cultural continuity from the Late Ahmarian by several, penecontemporaneous groups. The change in the socio-economic realms is recognized in the steppic areas where new and variable industries mark the movements of foragers from and into the habitable zone.

One of the clear cases for the penetration of foreign groups into the Levant, either from north-eastern Africa or the Syro-Arabian desert, is provided by the Early Mushabian assemblages that resemble industries recorded in north-eastern Africa and were found mainly in Sinai and the Negev. The Ramonian (originally named Late Mushabian) demonstrated the results of an interaction with the Early Natufian by the presence of the Helwan lunates. Similar variability was recorded on the eastern side of the Jordan-Arava Valley. Indeed, through the entire period of the Upper Palaeolithic and Epipalaeolithic, the prehistoric data sets accumulated in the last decades demonstrate ‘when’ and ‘how’ the Levant served as a major geographic corridor. As such it played a key role in being one of the most important highways in human evolution.

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The Later Epipalaeolithic (Natufian) Levant: A Brief History and Review

Brian Boyd

Introduction

This chapter outlines the initial discovery of the Natufian in the context of European “colonial” archaeology in the first half of the 20th century. This is followed by discussion of subsequent developments throughout the latter half of the century. The last section of the paper presents a critical overview of current interpretations of the Natufian, focusing on the issues of sedentism, plant and animal domestication, and the significance of the mortuary evidence.

Discovery of “the Natufian culture” 1928–1957

“As it will be convenient to have a name for this culture, I propose to call it Natufian, after the Wady en-Natuf at Shukba, where we first found it in place” (Garrod 1929, 222).

The archaeological material in the cave of Shukba, western Judaea, was initially discovered by Father Alexis Mallon of the University of St. Joseph in September 1924, on a journey from Jemmala to Lydda (Garrod 1942). He published his observations, based on surface lithic finds, in the *Melanges de l'Université de St. Joseph* (Mallon 1925) and subsequently, “waived his rights as discoverer” (Garrod 1928, 182). Garrod later said that Mallon generously suggested that the British School of Archaeology in Jerusalem should excavate the site (Garrod 1942, 1). And so, in February 1928 Garrod, along with George and Edna Woodbury from the American School of Prehistoric Research, began planning the excavation of Shukba cave which subsequently took place from April to mid-June of that year.

During the course of the two-month excavation, the cave’s main chamber (Chamber 1) was largely emptied of its archaeological deposits. The stratification was complex and “rather difficult to interpret” (Garrod 1942, 2), but three distinct archaeological layers were nonetheless discernable.

Layer A (Early Bronze Age to Recent), Layer D (“Upper Mousterian”) (Note: there was also Layer C which consisted of redeposited material from Layer D). It was Layer B, however, that proved to be the most significant in terms of the existing Levantine prehistoric sequence. This layer, 80–300 cm thick, contained a microlithic flint industry in association with a number of hearths, burnt animal bones, polished bone objects, and the fragmentary remains of several human skeletons. Garrod’s archive, held in the library of the *Musée des Antiquités Nationales*, St. Germain-en-Laye, provides an evocative account of these early days of the excavation:

4th April... Drew plan of cave. 5th April. Trench started against E. wall... At 70 cm depth found skeleton of a child, 165 cm from wall. It lay on its side with legs drawn up and hands behind head... (quoted in Smith *et al.* 1997, 270).

Lacking comparable Levantine data, Garrod noted similarities between the Shukba Layer B material and that of the late Capsian “kitchen middens” of North Africa (Garrod 1928, 183). The full significance of this microlith-dominated flint assemblage and its associated evidence did not become clear until the commencement of Garrod’s excavations at el-Wad (Wadi el-Mughara, Mount Carmel) the following year, and those of Frances Turville-Petre at Kebara (Turville-Petre 1932), and René Neuville in the Judean Desert (Neuville 1934, 1951).

In late 1928, large-scale development of the port in Haifa on the Mediterranean coast resulted in extensive stone quarrying from the cliffs of the Wadi el-Mughara (Valley of the Caves). Recognizing the archaeological potential of the caves, the Palestine Department of Antiquities negotiated with the Department of Public Works for Charles Lambert (Deputy Director of the PDA) to open test trenches at el-Wad cave and terrace in November 1928. Dorothy Garrod subsequently described this work:

...although he never reached a completely undisturbed layer he was able to demonstrate the great importance of the cave

as a prehistoric site. His most notable find was the carving in bone of Natufian date, which was the first example of Stone Age art to be discovered in the Near East (Garrod and Bate 1937, 3–4).

Equally important was his discovery of a microlithic stone tool assemblage closely resembling the material Garrod had previously found at Shukba. Lambert's finds (a piece of a carved bone depicting a cervid, a pierced deer scapula, and three human skeletons, all in association with the microlithic flint industry) resulted in the abandonment of Garrod's Shukba excavations, and she instead embarked on what would become seven seasons of work at the Carmel Caves.

Garrod's first season at el-Wad (April 1929) uncovered a large pit containing a collective burial of "four adolescents and six children" (Garrod 1929, 221) in the cave's outer chamber, in association with an in-situ microlithic stone tool industry. She was now able to bring together the comparable Shukba and el-Wad material, coining the term "the Natufian culture", and placing this in the "Mesolithic" of Palestine, based on features of the lithic industry – lunates, backed blades, core-scrappers – and the lack of ceramics (Garrod 1930, 153).

The picture of an indigenous Mesolithic Palestine was further expanded in 1931. Garrod wrote:

In travelling by train from Haifa to Jerusalem, I had often noticed a cave lying in the cliffs to the east of the railway just south of the station of Zikhron Yakob... I went over there with Mr. Theodore McCown and made a sounding. We were able to identify a Natufian layer... I thought it very important that the site should be worked together with the Mugharet el-Wad, and the British and American Schools therefore asked Mr. Turville-Petre and Mrs. Baynes to undertake the excavation (Garrod 1932c, 267).

The cave, Mugharet el-Kebara, previously tested by Moshe Stekelis in 1927, was excavated by Francis Turville-Petre in 1931, revealing a lithic assemblage similar to those from Shukba and el-Wad, a remarkable worked bone industry, and a number of human burials (Turville-Petre 1932).

Piecing all this together, Garrod constructed a chronology for the Mesolithic/Natufian, subdividing Layer B at el-Wad into Upper (B1) and Lower (B2), with Shukba Layer B corresponding with el-Wad B1 (later Natufian), and Kebara Layer B with el-Wad Layer B2 (earlier Natufian) (Garrod 1932a, 11). This was based on attributes of the chipped stone industry, primarily the relative frequency of Helwan (oblique bifacial) retouch on tools (particularly the crescent-shaped lunates) from earlier to later Natufian. In addition, microburins were numerous in the later phase, less so in the earlier, while worked bone objects, and artistic representations appeared more prolific in the earlier Natufian.

The large numbers of backed flint blades displaying "a

high degree of polish along the working edge" (Turville-Petre 1932, 272; also noted by Garrod 1931a, 1931b, 1932a, 1932b), combined with bone "sickle hafts" from both el-Wad and Kebara prompted Garrod (1931a, 10) to argue that Mesolithic Palestine witnessed "a primitive form of agriculture", and this observation has been one of the defining features of the Natufian ever since. Turville-Petre (1932, 272) also argued, "probably the most important object found (at Kebara) was a grooved bone sickle-blade haft".

The suggestion that "primitive agriculture" was practiced in Mesolithic Palestine was made prior to Gordon Childe's hypothesis that the Near East/Levant was the region where the origins of agriculture may be located (Childe 1934). At this stage (early 1930s), Garrod provisionally dated the Natufian to the 5th millennium BC, noting that "in the circumstances it may seem surprising that we get evidence of the practice of agriculture at such an early date among a people who possess no pottery and do not appear to have domesticated animals" (Garrod 1932c, 268).

Working at the same time as Garrod was the French Vice-Consul René Neuville. His excavations in the caves and rockshelters of the Judean Desert – Erq el-Ahmar, Oumm ez-Zoueitina, Tor Abu Sif, e'Khiam – led him to construct a four-phase chronology for the Natufian (Neuville 1934) which became the generally accepted chronological scheme for three decades:

- Natufian I: Large numbers of lunates with oblique bifacial retouch, backed bladelets, points, flat scrapers, lusted sickle blades, well-developed worked bone industry, art objects;
- Natufian II: Smaller lunates, sharp decrease in frequency of oblique bifacial retouch, appearance of microburins, borers, discoidal scrapers, scalene triangles;
- Natufian III: Even smaller lunates, less frequent and lacking oblique bifacial retouch, longer bladelets, microlithic scrapers, large number of microburins;
- Natufian IV: Similar to Natufian III, appearance of notched arrowheads.

Following the end of Dorothy Garrod's Mount Carmel excavations, she published the article "The Stone Age of Palestine" (Garrod 1934), in which she restated that since no pottery had been found in any known Natufian deposit, then it could be "truly described as Mesolithic, even though the presence of sickles points to the existence of some form of agriculture (Garrod 1934, 138). Subsequently, she raised the question as to the origins of the Natufian, which she believed lay outside the Levant:

Natufian art shows no Predynastic affinities, nor, in spite of certain superficial resemblances, can it be linked with that of the Magdalenian, to which it is inferior. In the matter of Natufian origins we have everything to learn, but it is a fairly safe guess that excavation in Anatolia would throw light on this problem (Garrod 1936, 128).

Neuville (1934, 128), on the other hand, argued that the Natufian lithic industry showed continuity from the Levantine Upper Palaeolithic. By the time of the final publication of the Mount Carmel excavations (Garrod and Bate 1937), Neuville's Natufian chronology was generally accepted. Garrod agreed that Neuville's Natufian I corresponded with Lower Natufian B2 at el-Wad but had reservations about his placing of el-Wad B1 somewhere between Natufian II and IV: "In the main, Neuville's classification appears to be valid, but it needs to be confirmed, especially as regards the middle stages, by further excavation" (Garrod and Bate 1937, 117).

Indeed, changes to Neuville's chronology became necessary as he continued excavations at el-Khiam. He noted that Natufian IV's characteristic notched arrowheads (see above) also appeared in Natufian III, leading him to redefine Natufian IV as characterized by denticulated sickle blades, the use of pressure-flaking techniques, and a new type of arrowhead (Perrot, in Neuville 1951). Further, Neuville proposed that Natufian I (which he dated to 10–12 millennia BP), saw the earliest appearance of cereal cultivation, with Natufian III and IV witnessing the domestication of cattle, pig and goat (Neuville 1951, 217). Robert Braidwood (1956), working in other areas of the Near East and Mesopotamia, disagreed, arguing instead that the Mesolithic economy was based on the hunting of wild animals and the gathering of wild cereals, although he believed that the earliest steps towards plant and animal domestication occurred during this period.

The question of agriculture was raised again in Dorothy Garrod's final words on the Natufian. Noting the high proportion of sickle blades from Natufian sites, and the care spent adorning some of the bone hafts, she agreed with René Neuville "in thinking that the Lower Natufian people were probably the first agriculturalists" (Garrod 1957, 216). In terms of animal domestication, however, she argued – based on her colleague Dorothea Bate's faunal analysis at Shukba and el-Wad – that only the dog was domesticated during this period. The lack of any substantial architecture seemed to indicate that cereal cultivation predated sedentism and settled village life, a view shared by most researchers at the time. Finally, Garrod reversed her earlier opinion on Natufian origins. Rather than regarding Anatolia as the source, the lack of archaeological evidence to support this claim led her to say that "the Natufian makes its first appearance apparently full-grown with no traceable roots in the past" (Garrod 1957, 225).

Changes to the traditional view

So, the general consensus in these early European interpretations of the "Natufian Culture" was that here were communities of Mesolithic hunter-gatherers practising some cereal cultivation, with the very beginnings of animal

domestication. Within a decade, however, this view of the Natufian had changed, mainly as a result of new archaeological evidence from excavations at Tell es-Sultan/Jericho (Kenyon 1952, 1959) in the lower Jordan Valley, Nahal Oren – the first Israeli-led Natufian excavation – in the Mount Carmel region (Stekelis and Yizraeli 1963), and Eynan/Ain Mallaha in the upper Jordan Valley (Perrot 1960, 1966). The first radiocarbon dates for the aceramic/pre-pottery Neolithic levels at Jericho placed the stratigraphically earlier Natufian layer at the tell to 10,000–8000 BP. This estimated date was subsequently confirmed by dates from charcoal samples taken from the Natufian layer itself (Kenyon 1959, 5–9). Further, the discovery of stone architecture at Nahal Oren and Eynan/Ain Mallaha seemed to indicate that these Mesolithic hunter-gatherers were in fact the first settled village communities. Jean Perrot, director of the Eynan/Ain Mallaha excavations, produced a new synthesis, arguing for recognition of the Natufian as "a cultural and ethnic whole" as displayed in the homogeneity of its flint, groundstone and bone industries, its art objects, and its mortuary practices (Perrot 1966). Further, based on the archaeological evidence from Eynan/Ain Mallaha, Perrot argued that the Natufian economy was based on hunting and gathering rather than animal domestication and the cultivation of cereals (the apparently domesticated dogs of Shukba and el-Wad now became referred to as wolves until relatively recently (see below). All this led him to suggest that the Natufian should be labelled "Epipalaeolithic" rather than "Mesolithic", as a way of demonstrating economic and technological continuity with the Upper Palaeolithic. By the late 1960s, then, a rather different interpretation of the Natufian had emerged: sedentary hunter-gatherers with indigenous origins. This view remains influential, albeit with some refinements (see next section).

Research on the Natufian took a further turn with the advent of Ofer Bar-Yosef's doctoral work (Bar-Yosef 1970), in which he proposed a more refined definition for the material excavated thus far. Alluding to the concept of a geographical "centre/core and periphery", he put forward a hierarchy of Natufian sites according to site size and features:

1. Base camps: these were large sites in the terra rossa Mediterranean zone, with a flint tool industry characterized by crescent-shaped lunates, sickle blades, groundstone artefacts, stone-built architecture and other structures, human burials, and art objects;
2. Seasonal camps: smaller sites within a 50 km radius of base camps. They generally had only a lithic industry, with no, or few, other artefact technologies, little in the way of architecture, and no mortuary evidence. Seasonal camps in the arid and semi-arid zones, and in the Lebanese mountain area, it was suggested, had only tenuous links with the core Natufian Mediterranean area.

The 1970s saw further refinements in the shape of Donald Henry's chronology for the Natufian, based on attributes of the lithic assemblages (Henry 1973, 1974) and, particularly, the work of François Valla (1975) who presented the most complete synthesis to date. Valla proposed a more geographically extensive and culturally diverse definition for the Natufian than that of Bar-Yosef. Moving away from equating the Natufian with Mediterranean zone base camps (the Natufian "core"), Valla advocated a regional approach, stressing the need for more fieldwork in Syria, Lebanon, Jordan and Egypt in order to build a more detailed chronology. He developed this approach throughout the 1980s (Valla 1981, 1984, 1987), constructing a tripartite chronology (Early, Late and Final Natufian) based not only on lunate attributes, but also on quantitative and qualitative analysis of other flint artefact types and radiocarbon dates. This regional perspective was strengthened throughout the 1970s and 1980s by growing fieldwork in Lebanon (*e.g.*, Copeland 1991; Schroeder 1991), Syria (Cauvin 1977; Moore 1975; Moore *et al.* 2000) and Jordan (*e.g.*, Betts 1983, 1984; Edwards 1991), as well as in the so-called Natufian "core area" of central and northern Israel (Belfer-Cohen 1988; Valla *et al.* 1989, 1991; Bar-Yosef 1991). Mention should also be made of the southern Israel desert region, the Negev, where Nigel Goring-Morris conducted extensive fieldwork on not only the Natufian, but also its "desertic adaptation", the Harifian (Goring-Morris 1987, 1991).

Recent approaches

At this point in our historical account of the Natufian, it is appropriate to shift the nature of the narrative. The major conference, held in 1989, "The Natufian Culture in the Levant" (and subsequently published, Bar-Yosef and Valla 1991) in many ways signalled the beginning of different ways of thinking about the Natufian as new generations of scholars began to engage with the archaeological material. Indeed, in their introduction to that volume the editors commented that, "Undoubtedly, much of the renewed research will arise from theoretical approaches that cannot be tested on the basis of the available data" (Bar-Yosef and Valla 1991, 7). At the time of writing, "The Natufian Culture in the Levant II" is due to take place, twenty years after the original conference (in September 2009). The remainder of this chapter considers the major themes and issues that have emerged in the intervening period.

First, it should be noted that the development of field techniques at a number of major Natufian sites has contributed immensely to our understanding of the material evidence. At Eynan/Ain Mallaha, the use of open area excavation (*décapage horizontal*) since the early 1970s, but particularly in the renewed excavations from 1996 to the present day, has yielded detailed spatial and architectural information

relating to the hitherto poorly understood final phase of the Natufian (Valla 1988, 1991; Valla *et al.* 1998, 2001, 2004; Samuelian 2006). Similarly, the adoption of "*l'anthropologie de terrain*" (initially pioneered by Henri Duday and colleagues, *e.g.* Duday and Masset 1987; Duday *et al.* 1990), has led to sophisticated taphonomic analyses of human skeletal material and its associated deposits at Eynan/Ain Mallaha (Bocquentin 2003; in Valla *et al.* 2004) and in the new excavations of the Late Natufian levels at Rakefet Cave, Mount Carmel (Nadel *et al.* 2008). Added to this, the last decade has seen renewed excavations at el-Wad Cave and Terrace (Weinstein-Evron 1998), and this work has recently been augmented significantly by a highly informative – and extensive – piece of historiographic research into the 1920s and 1930s fieldwork archives of both Dorothy Garrod and Charles Lambert (see above) (Weinstein-Evron 2008). Smaller scale projects continue to be informative. Amongst others, Garrard and Yazbeck's recent work in Lebanon (Garrard and Yazbeck 2004), Akazawa's (unpublished) excavations at Deditriyeh Cave in northwest Syria, and Hillazon Tachtit in western Galilee (Grosman *et al.* 2008).

Alongside this fieldwork, another strand of interpretive thinking has emerged in recent years (as predicted by Bar-Yosef and Valla, see above), that is engaging with current perspectives in archaeological – and wider humanities/social sciences – theory. These studies attempt to make a break with the social evolutionary and environmentally/ecologically driven explanations that still characterise much of the current literature on the relationship between the difference phases of the Natufian (Early, Late, Final) and the subsequent Neolithic period with its "package" of domesticated plants and animals, settled village life, and so on. A number of these theoretically-oriented studies appear in Delage (2004) and elsewhere (*e.g.*, Peterson 2002; Boyd 2006), with a focus on social landscapes, ritual and symbolism, agency and materiality, the social aspects of food consumption, gender, and "non-Cartesian" perspectives on the perceived transition to the Neolithic.

It is clear that engagement with the wider humanities and social sciences have transformed much prehistoric archaeology in Europe and, perhaps lesser so, in the United States. Further, the results from a number of Pre-Pottery Neolithic and Neolithic sites in the Levant and Anatolia in recent years have forced a major rethinking of those periods (*e.g.*, Çatalhöyük, Göbekli Tepe, Jerf-el Ahmar, Tel Aswad, Kfar HaHoresh, amongst others). Surely the evidence from the Natufian is begging for such reinterpretation in the years to come.

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Bridging the Gap Between In and Out of Africa

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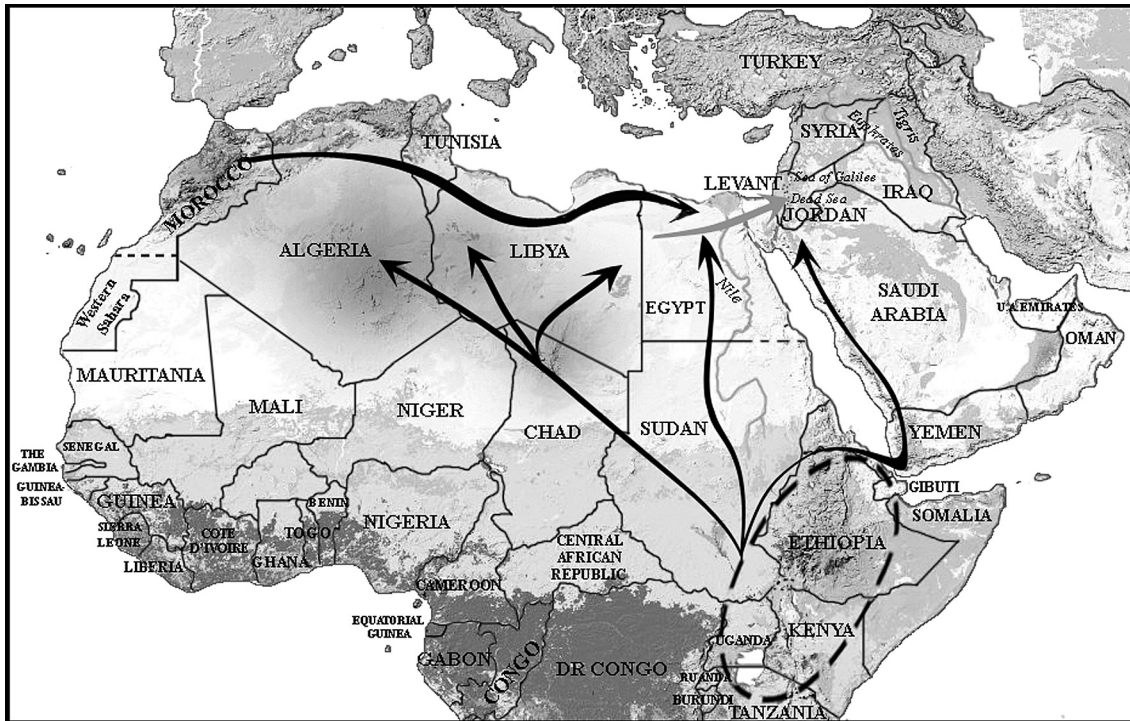
This final chapter draws together the threads on the state-of-the-art of the latest discoveries, interpretations, and discussions on the south-eastern Mediterranean peoples between 130 and 10 ka BP, as provided by the authors of the previous chapters. Amongst the numerous interesting aspects considered, some appear particularly significant and helpful in bridging the gap between in and out of Africa. Those that appeared as the most crucial events have been chosen for these final considerations and are summarised and commented on in the following pages. They include the Out-of-Africa 2 movement, the Middle/Upper Palaeolithic transition, the cultural changes at the end of the Pleistocene, and the ultimate food production “revolution.”

Out of Africa 2

The migration and spread of *Homo sapiens* into Eurasia have been extensively discussed in the current scientific debates. To date, the Out-of-Africa model for the origin of modern humans (*e.g.*, Stringer and Andrews 1988; Stringer and Bräuer 1994; Bräuer and Stringer 1997) seems to find stronger support than the replacement, assimilation, or multiregional models (for a review, see, Aiello 1993; Stringer 2001). Under the Out-of-Africa scenario, various routes have been supposed for the exit of the African *Homo sapiens*. The Mediterranean coast of North Africa, the Sahara, the Nile Valley, and the Red Sea coast could have been corridors leading out of Africa, and conceivably, the Bab el Mandab could have connected the Horn of Africa to the Arabian peninsula (Fig. 11.1). Even though data are still scanty to support one hypothesis against the others, scholars have tended to search for “the” route out of Africa, as if one passageway would rule out possible others. However, it should be considered that a single-dispersal model may not be correct as early modern humans may have found different ways to leave their native lands. If North Africa can contribute to an understanding of the adaptational dynamics of modern human peopling and their radiation

towards different parts of the world (cf. Hublin and McPherron 2010), other regions, such as the Horn of Africa, may be contemplated as well, at least until more compelling, indisputable data become available (*e.g.*, Petraglia and Alsharekh 2003; Beyin 2006; Mellars 2006). According to this viewpoint, multiple-dispersal events out of Africa, produced by intra-African population expansions of isolated groups, may be a most appropriate interpretation, as now neurocranial geometric morphometrics also indicate (Gunz *et al.* 2009).

Accepting multiple dispersal does not imply denying that the Levant was “a biogeographic corridor” for plants, animals, and modern humans between Africa and Eurasia, particularly during humid periods (Shea, Chapter 8). In fact, palaeoenvironmental evidence shows that the southern Levant was similar to North Africa, even more than its central and northern parts. In the south, monsoonal rains occurred during interglacial or warm periods, whereas in the central and northern Levant, rainfall was recorded during cool, glacial, and arid periods. On the other hand, water resources in the Levant appeared as more abundant than in North Africa, particularly after the end of MIS 5, when the weather became particularly challenging in North Africa. Extensive lacustrine or spring deposits are not recorded in the eastern Sahara outside of oases during glacial periods. During MIS 4, only groundwater activity and occasional localized small lacustrine deposits are attested to in the Egyptian Western Desert (Smith, Chapter 2). On the other hand, in the Levant, Lake Lisan existed between 70 and 15 ka BP, extending from the present Dead Sea to the Sea of Galilee and reaching a maximum length of 220 km from north to south (Niemi 1997; Smith, Chapter 2). Particularly wet conditions with an increase in Mediterranean evergreen and deciduous forest taxa in the Levant may have favoured the first migration out of Africa, as pollen analyses of sapropel deposits and Nd-isotope indicate for MIS 5e, *i.e.* around 125–120 ka BP (Smith, Chapter 2). Furthermore, the Negev desert appeared to have acted as a climatic



“transition zone” between the Mediterranean belt and the Sahara. It also exhibited differences in speleothem growth between the northern and the central and southern zones, in the latter, growing during the last interglacial period, between *c.* 140 and 110 ka BP, and being associated with monsoonal rainfall (Vaks *et al.* 2007; Smith, Chapter 2).

To date, it has been demonstrated that anatomically modern humans were not always successful once they departed from Africa and moved towards the temperate and dry latitudes of the south-eastern Mediterranean basin. Two distinct movements have been recognised within the Out-of-Africa 2 model, one occurring between *c.* 130 and 80 ka BP, the other taking place after 50 ka BP. The two phenomena were separated by an abrupt climatic transition that affected the south-eastern Mediterranean basin during the transition from MIS 5a to MIS 4, around 74 ka BP, and forced *Homo sapiens* to recede from the Levant between *c.* 80 and 50 ka BP (Shea 2003).

Both dispersals chronologically correlate with the Aterian industrial complexes in North Africa. The earliest available dates from this cultural unit, coming from long stratigraphic sequences in caves on the Atlantic (Dar es-Soltan I and Contrebandiers) and Mediterranean coasts of Morocco, appear to place the earliest Aterian horizon at the beginning of the Upper Pleistocene, around 122–121 ka BP (Barton *et al.* 2009; Schwenninger *et al.*, Chapter 3). Evidence for the Aterian dating from the very beginning of MIS 5 has also come from elsewhere, even regions which are far from the Atlantic and the Mediterranean coasts, such as the Adrar Bous, in the Nigerien Sahara, where this industrial complex was dated between ~150 and ~45 ka BP (Williams 2008). Presently, the stratigraphic deposits in the Moroccan caves

are the most accurately and thoroughly dated and age determination of other geostratigraphic sequences should be fostered from other parts of North Africa. The early dates of some Aterian occupational levels definitively solve the doubts on who were the first anatomically modern humans who moved from North Africa into the Levant.

A further undertaking for a better comprehension of the Aterian should be to seek a better techno-typological definition of its industrial complexes and its differentiation – both technological and stratigraphic – from the early Middle Stone Age, whose existence seems to still be controversial (cf., among others, Caton-Thompson 1952; McBurney 1967; Ferring 1975; Marks 1975; Debénath *et al.* 1986; Wendorf and Schild 1992; Wengler 1997; Garcea 2001; Richter 2010; Schwenninger *et al.*, Chapter 3). It is quite likely that the first spread towards North Africa of anatomically modern humans from East Africa occurred before MIS 5, during MIS 6, or possibly even MIS 7. Therefore, finding a way to recognize and distinguish the industries associated with the first *sapiens* is crucial. Extensive excavations with the collection of quantitatively significant lithic assemblages at well-preserved sites would facilitate overcoming the ambiguity created by the identification of single ‘guide fossil’ types, such as tanged tools. Other parameters have been correctly identified and suggested (Kleindienst 1998; Hawkins 2001), although they have been rarely taken into account and cannot be implemented on very small assemblages with a few artefacts, whereas they can be essential, and possibly also associated with other indicators, in comprehensive technological approaches to lithic analysis.

During the first migration out of Africa, modern humans seem to have failed in the competition for resources against Neanderthals, whereas they succeeded in their second migration. As these two events exhibit very distinct features and are divided by a long timespan, it seems reasonable to refer to the first event as “Out of Africa 2a” and to the second one as “Out of Africa 2b”. The Out-of-Africa-2a migration did not succeed because, as Shea (Chapter 8) suggests, African modern humans were not as adjusted as Neanderthals to cope with the cold climatic conditions that abruptly appeared at the onset of MIS 4 in the Levant. On the other hand, the Out-of-Africa-2b movement occurred under twofold favourable conditions, a natural, climatic one and a cultural, technological one. First of all, climatic conditions improved during MIS 3: the speleothems in the Soreq Cave, in the Levant, document increased precipitation around 54 ka BP and lacustrine deposits at Lake Lisan confirm humid conditions during the same time period (Bar-Matthews *et al.* 2000; Smith, Chapter 2). Secondly, this succeeding wave of African migrating modern humans was equipped with new technological hunting gear, projectile armatures, which provided them with a more effective tool than thrusting spears, and allowed subsistence diversifica-

tion, systematic exploitation of small prey species, and successful hunting of large game, which had also positive consequences on social organization, alliances, and networks (Shea, Chapter 8).

The fortunate discovery of a lithic workshop and a burial, dating to about 75 ka BP, at Taramsa 1, Upper Egypt (Vermeersch, Chapter 6) provides direct information on the anatomical characteristics of the makers of the Taramsan industrial complex and, vice-versa, on the technology produced by these human groups. As the skeleton appears to share many features with both the robust Epipalaeolithic ‘Mechtoid’ populations of North Africa (Vermeersch *et al.* 1997) and the early anatomically modern humans of the Levant (Vermeersch, Chapter 6), it may be correlated with the first phase of the Out-of-Africa model and included in the Out-of-Africa-2a movement.

As Aterian hunter-gatherers were adapted to living in dry lands, it is not surprising that they did not settle along the Nile Valley. They may have moved into the Levant from the Sahara and/or they may have gone along the Mediterranean coast (Garcea 2010), and, at the same time, groups who occupied the Nile Valley, such as those producing the Taramsan industry, may have used the river as another route of dispersal (cf. Vermeersch, Chapter 6; Van Peer *et al.* 2010). If the theory of multiple dispersal events out of Africa by isolated groups, which subdivided within Africa, is correct, it would be archaeologically reasonable to envisage different human groups, possibly with different technological backgrounds, moving out of Africa, following different corridors (see also Osborne *et al.* 2008). Within this scenario, northern Libya would have played a fundamental role, as studies of sapropel formations indicate. The deposition of sapropel S5 between 124 and 119 ka BP has shown a fossil river system in Libya, which created a humid corridor connecting the Tibesti mountains in the central Sahara with the Mediterranean Sea, with a concomitant northern penetration of the African monsoon (Rohling *et al.* 2002; Osborne *et al.* 2008; Paillou *et al.* 2009; Smith, Chapter 2). Furthermore, during the Upper Pleistocene interglacials, Libya appeared as a lake district with several closed basin lakes, the major ones being Lake Megafazzan and an inland delta in northern Libya formed by the Kufra river (Drake *et al.* 2008; Smith, Chapter 2).

Middle/Upper Palaeolithic transition

As Neanderthals did not live in Africa, the transition from the Middle Stone Age (or Middle Palaeolithic) to the Later Stone Age (or Upper Palaeolithic) on this continent did not involve any human biological replacement, although technological and cultural transitions did occur. The first inklings of a technological transition from the Middle to the Upper Palaeolithic in the Nile Valley seem to be attested to in the Taramsan industry (Vermeersch *et al.* 1997;

Vermeersch, Chapter 6). The technological features of the reduction sequences for the production of this lithic industry have suggested a development of the Levallois method, which changes from the exploitation of the surfaces of cores to the exploitation of their volumes, in order to obtain a high production of blades. This new technique finds comparisons with the Emiran of the Levant, where it appears later than at Taramsa (Van Peer 2004), confirming likely connections between the Nile Valley and the Levant (Vermeersch, Chapter 6). Given this innovative lithic technology for the production of blades and its settlement organization, Vermeersch (Chapter 6) suggests that the Taramsan was produced by highly organized human groups who seem to anticipate the Upper Palaeolithic.

Another significant cultural transition took place in North Africa around *c.* 40 ka BP. In northern Libya, both stratigraphic and chronological evidence indicates lithic complexes that followed the Aterian and that are assigned to the Lower Later Stone Age in western Libya and to the Dabban in eastern Libya, even though there was a significant demographic contraction between about 40 and slightly before 20 ka BP. These industries exhibit both signs of continuity with previous Aterian traditions and evidence for cultural change. Evolutions from the previous period include the use of the hafting technique and the conservation of the same settlement systems; innovations comprise the blade technology for the production of chamfered and backed pieces, the microlithic technology for the production of composite tools, and the use of the soft hammer and the punch techniques (Garcea 2009).

A demographic contraction, or at least a decrease in the intensity of human occupation, although without total abandonment, was also observed in the Maghreb, where, at Taforalt cave, two sporadic human occupations were dated to 30–29 and 26–25 cal ka BP, respectively (Barton *et al.* 2007). The relations of these blade-bearing lithic assemblages with previous, Aterian, or subsequent, Iberomaurusian industrial complexes, seem to be unclear for the time being (Barton *et al.* 2007). Nevertheless, their existence is sufficient to highlight previously unknown human presence between the two intensively populated periods, associated first with the Aterian, until about 40 ka BP, and then with the Iberomaurusian, after about 20 ka BP.

Traditionally, chamfered blades have been considered as the most significant tool type showing similarities between the Early Dabban and the Levantine Upper Palaeolithic (Marks 1975; see also Garcea, Chapter 5; Bar-Yosef and Belfer-Cohen, Chapter 9). If this correlation still holds true, at least three remarks should be made. First of all, chamfered blades and flakes characterise the northern province of the Levant and are “the” tool type that differentiate the northern Levant from the southern province, which, in spite of being closer to Africa, is exactly distinguished for the lack of chamfered pieces and the

presence of Emireh points (Bar-Yosef and Belfer-Cohen, Chapter 9). I have tentatively suggested (Garcea, Chapter 5) that either some traditions may have diffused where they were functionally useful and culturally convenient, or that some sites are presently below the sea level, which temporarily uncovered extensive coastal plains during MIS 3 (*e.g.*, Van Andel and Tzedakis 1996), where some sites may have been located. A second remark concerns the different chronology of chamfered pieces in the Levant and North Africa. In the former region, they date to *c.* 50–40 ka BP (Bar-Yosef and Belfer-Cohen, Chapter 9), whereas, in the latter region, they do not seem to be earlier than 40 ka BP, the time of the beginning of the Early Dabban. If the chronology of the Dabban is correct, although it is still based on McBurney’s determinations (McBurney 1967), and if chamfered blades are not a result of convergence, they would have been introduced into North Africa from the Levant. On the other hand, it has been suggested that the Dabban evolved from the local North African Aterian, or that at least the human groups who inhabited that region underwent an endemic cultural evolution (Garcea, Chapter 5). These considerations lead to the third remark and open a new perspective on the relations that Levantine and North African inhabitants may have maintained between each others after 40 ka BP. It would then be reasonable that, once anatomically modern humans were definitely settled in the Levant and the same, culturally alike, species occupied the entire territory – in and out of Africa – the African and Levantine Mediterranean coasts may have acted as open, two-way corridors.

Geographically, the southern Levant, which is more closely located to North Africa, would be in a better position for understanding the relations of the two regions. In fact, also the Emiran, the other Levantine Initial Upper Palaeolithic industrial complex, appears to have some analogies with the Dabban (McBurney 1967). With regards to North Africa, McBurney suggested a cultural replacement of the previous Aterian from the east by groups skilled in the laminar technology, which now seems to be an excessive interpretation as there is no need to envisage a whole population replacement to explain a cultural change, even a significant one, as is the case of the new volumetric conception of lithic reduction sequences, as the one implied by laminar productions. Whether the Emiran is an indigenous Levantine industry produced by anatomically modern humans who spread to the Levant from Africa (Shea 2008), or a “transitional industry”, which resulted from a gradual cultural shift from the previous Levantine Mousterian, with also some biological implications on the Neanderthal/*sapiens* succession (for a summary of the debate, see Bar-Yosef and Belfer-Cohen, Chapter 9), the Emiran is earlier than its African counterparts, the Dabban, as well as the Taramsan. Therefore, the presence of Emireh points in the Dabban may further corroborate the use of the Mediterranean

coast as a two-way corridor for now widely spread fully modern humans across our imaginary border between the African and the Asian continents.

The early assumption that anatomically modern humans descended from Neanderthals in the Levant (see Bar-Yosef and Belfer-Cohen, Chapter 9) seems to have resulted from a confusion in the cultural attribution of the technological productions, which appeared to suggest a gradual shift with continuity from the Middle Palaeolithic to the Initial Upper Palaeolithic industries. The observation of lithic complexes including a combination of typically Middle Palaeolithic elements, such as sidescrapers, flake points, and Levallois technology, and Upper Palaeolithic elements, such as endscrapers, burins, and blade technology (Bar-Yosef and Belfer-Cohen, Chapter 9), justified technological taxonomic criteria, which, in turn, led to the assumption of biological continuity between Neanderthals and modern humans. Therefore, the presence of Middle Palaeolithic markers was taken as the indicator of their makers, that is, Neanderthals. A similar misinterpretation existed regarding the human fossils associated with early MSA lithics at Jebel Irhoud, in Morocco. They were originally thought to represent Neanderthal morphologies (Ennouchi 1962; Tobias 1967, but see Tobias 1968) because they were associated with a “Mousterian” lithic industry. More specific anthropological analysis on the human remains demonstrated that they were different from Neanderthal types and could be included in the *sapiens* population (Howell 1978; Hublin 2001).

Unlike Africa, the Levant did see a human biological ‘revolutionary’ shift with the transition from the Middle Palaeolithic to the Upper Palaeolithic. With the Out-of-Africa-2b event, Neanderthals were supplanted by anatomically modern humans, who were equipped with projectile armatures, a technology apparently unknown to Neanderthals which appeared to be a key-factor in the success of the second wave, Out of Africa 2b, of *Homo sapiens* populations (Shea, Chapter 8). While the Middle Palaeolithic in the Levant was a period of alternating successes and failures for both Neanderthals and modern humans, the Upper Palaeolithic was an event of rapid and, this time, irreversible spread of modern humans with their adaptive strategies and technology across the Asian and European continents (Shea, Chapter 8).

Ultimately, in the Levant and eastern Europe, striking techno-typological similarities occurred in the local Initial Upper Palaeolithic industrial complexes, produced by the newcomers modern humans of the Out-of-Africa-2b movement on a large geographic scale, extending from the Negev to Moravia, in the Czech Republic. Therefore, it has been suggested that migrations took place at a considerably fast pace during a rather short timespan, comprised between 50 and 40 ka BP (Bar-Yosef and Belfer-Cohen, Chapter 9).

End of the Pleistocene

The cultural units associated with the final part of the Pleistocene comprise the Late Upper Palaeolithic or Iberomaurusian in Morocco, the Upper Later Stone Age or, also, Iberomaurusian in Libya, the Late Palaeolithic in the Nile Valley, and the Epipalaeolithic in the Levant. In spite of the confusing and apparently contradictory terminologies, these cultural units have several characteristics in common, regarding their absolute chronology and technological solutions. The first and most remarkable one is that all of them, whatever their label may be, flourish slightly before 20 ka BP, at the time of the Last Glacial Maximum.

Schild and Wendorf (Chapter 7) consider that the people at the time around the Last Glacial Maximum were forced to live near the only available resources, which the Nile river could offer under hyper-arid climatic conditions. They note a sort of cultural border at the First Cataract, separating the lithic technocomplexes to the south of it, which seemed to be linked with the southern regions, and those to the north of it, which were connected with the Mediterranean traditions. They observe numerous technological elements in common between the Fakhurian, dated to ≥ 24.4 –22.5 ka BP, and possibly the Kubbaniyan, dated to 21–19.5 ka BP, and the Iberomaurusian of the Maghreb. If this is the case, and considering that the Sahara was uninhabited from the end of the Aterian until the beginning of the Holocene occupations, the Mediterranean coast must have been the only feasible corridor connecting the Nile Valley to the Maghreb during this time.

With regards to technological solutions, Bar-Yosef and Belfer-Cohen (Chapter 9) point out the continuity in the production of bladelets from the Late Ahmarian into the Epipalaeolithic and, therefore, suggest that a “cultural boundary” at the end of the Upper Palaeolithic, dated to 23–22 ka BP, seems artificial. Nevertheless, they do acknowledge that some technical changes, such as the production of abruptly retouched bladelets and the use of the bipolar (*sur enclume*) technique, did occur. According to them, the production of microliths to make composite hunting tools should be seen as a sign of increasing efficiency. Likewise, in North Africa, the assignment of the Iberomaurusian to either the “Upper Palaeolithic” or the “Epipalaeolithic” has wavered between the two periods, depending on whether attention was paid to its chronology, in the former case, or to its technology, in the latter case. These considerations allow me to reiterate that a single phase of the timespan between the end of the Aterian and the end of the Pleistocene, namely the Later Stone Age, subdivided into Lower (Dabban, etc.) and Upper (Iberomaurusian), would overcome these artificial cultural boundaries, which sound so similar to those in the Levant.

The ultimate “revolution”

The end of the Upper Pleistocene sees the first inklings, in both North Africa and the Levant, of some indications of the “Neolithic revolution” which, in these two regions, will appear in the Holocene with different and diverging aspects of animal and plant domestication for food production. As a matter of fact, the Holocene may be the time when these regions make the most different choices in the manifold aspects of food production and its related social and technological implications. However, if we reverse the perspective and look at what the human populations of North Africa and the Levant did at the end of the Pleistocene and consider it as the ultimate outcome of the long-lasting process initiated by early modern humans, not the spark of a revolution, we can recognize, once again, parallel social and economic solutions, locally adapted to the environmental conditions they lived in.

The Levant, in the Terminal Pleistocene, c. 14.5 ka to 11.5 ka cal. BP, sees a new, important development of the Epipalaeolithic, featuring the emergence of sedentism, probably accelerated by an increased demographic pressure, which caused territorial packing and led to the Natufian culture. Increasing economic and social complexity involved an advanced organizational system long before food production. In the Natufian (12.8–10.3 ka BP), which is now included in the Later Epipalaeolithic, the first settled village communities developed an array of technological solutions, including stone architecture, heavy-duty artefacts, bone industries, art objects, storage pits, and mortuary practices, which suggest varying degrees of sedentism (Boyd 2006, Chapter 10). Sedentism, however, should not be conceived as either a switch or a precondition for successive transformations that will eventually occur in the Neolithic, but it rather is a gradual process of adaptation to constantly changing environmental and social conditions (cf. Marshall 2006).

Within the same perspective, the taming of aurochs in north-eastern Africa can be viewed as a similar way to develop new forms of adaptation. Schild and Wendorf (Chapter 7) resume biological and ecological argumentations to demonstrate intentional taming of indigenous wild aurochs by humans and add genetic and linguistic evidence to corroborate their interpretation. According to them, aurochs would have been tamed in the Nile Valley by Arkinian groups, dated between 12.8 and 10 ka BP. This Nilotic population would have expanded into the Western Desert and brought tamed aurochs, or cattle, giving rise to the local variant of the El Adam complex. Cattle rearing implied the adoption of a nomadic way of life, as so required the search for seasonally variable grazing lands. Increased nomadism, associated with food-production economy, would appear as a contradiction, or even an incongruity, to those who uncritically and mechanistically take the concept of

“Neolithic package”. But the places where the Neolithic package, as a whole, appeared are extremely rare, and certainly not in North Africa or in the Levant.

If technological and economic choices in the Levant and North Africa were different at the end of the Pleistocene, we can still discern a common denominator in the south-eastern Mediterranean basin. On one hand, we recognize a new need to enculturate the landscape, on the other, that to make it visually manifest. These culminating phases bring this book to an end, but continue to reflect a shared continuous adapting pattern that Upper Pleistocene humans undertook and materially expressed according to the opportunities they found.

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